United States
Department of
Agriculture

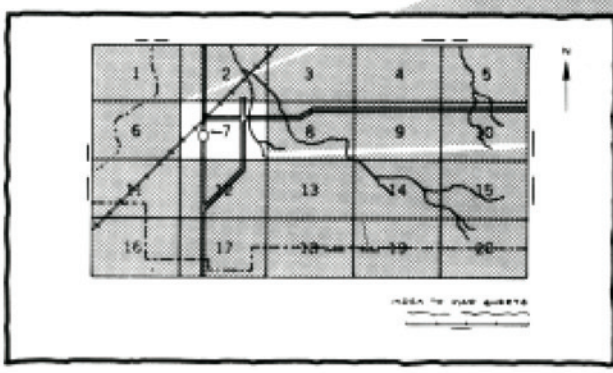
Soil
Conservation
Service

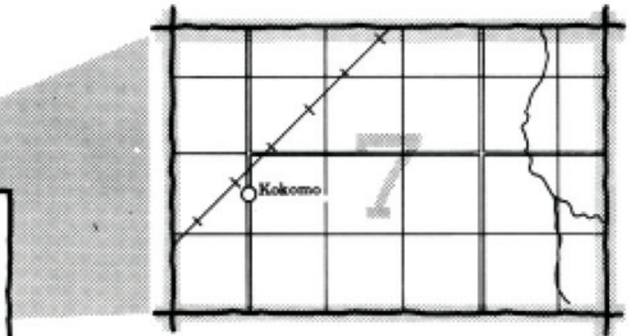
in cooperation with
Iowa Agriculture and
Home Economics
Experiment Station
Cooperative Extension
Service
Iowa State University
Department of Soil
Conservation
State of Iowa

Soil Survey of Butler County Iowa

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"





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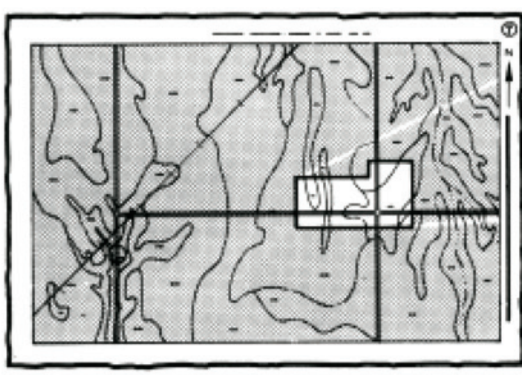

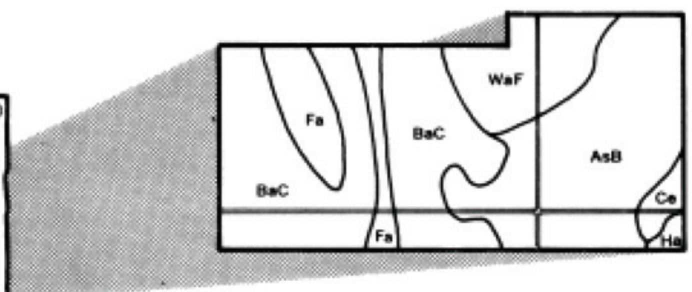

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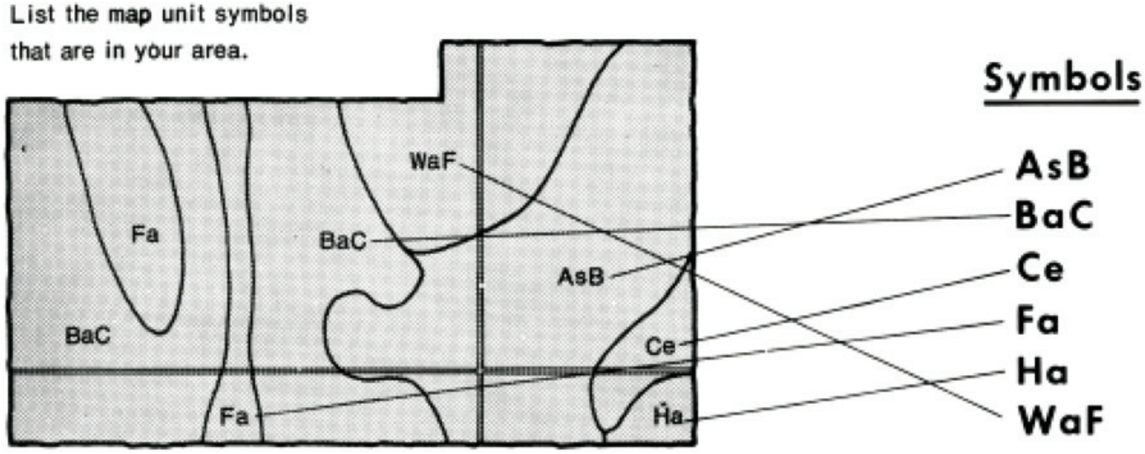
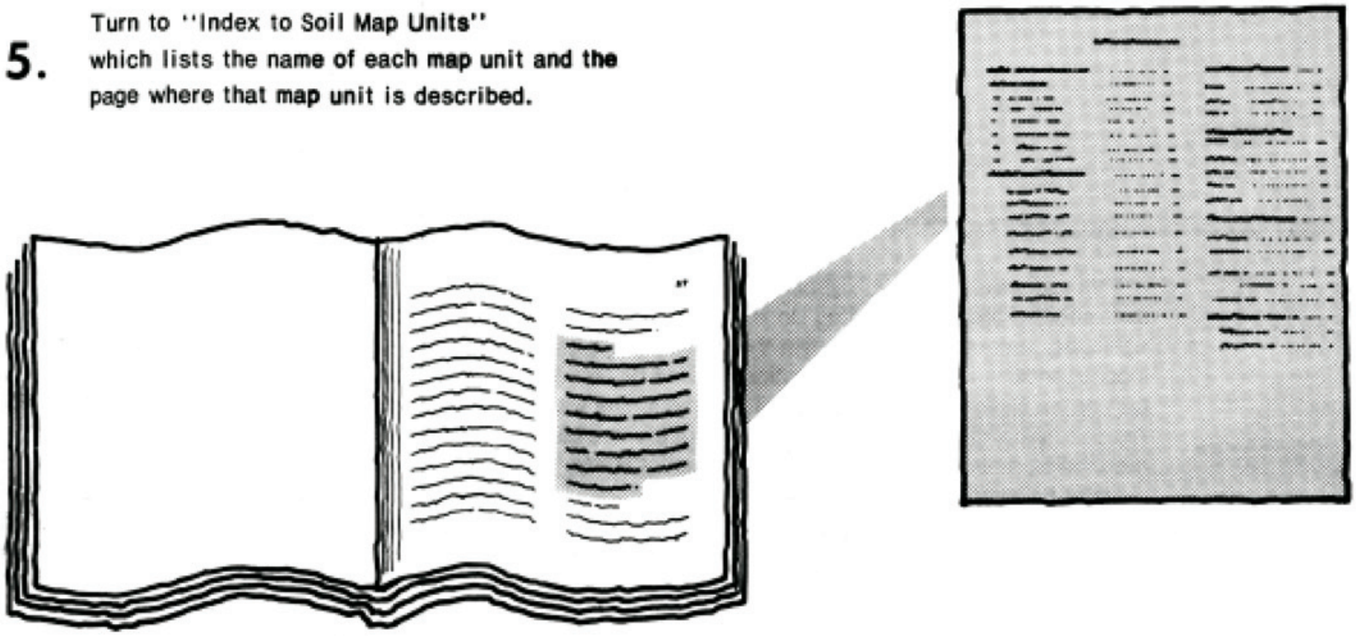
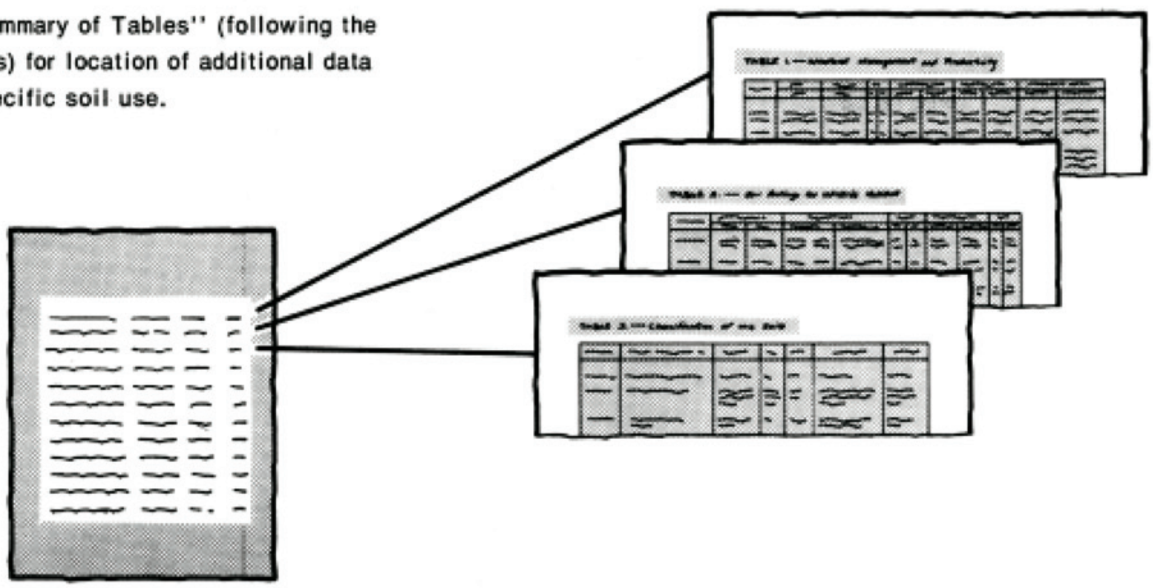


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1972-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the Iowa Agriculture and Home Economics Experiment Station, Cooperative Extension Service, Iowa State University, and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Butler County Soil Conservation District. Funds appropriated by Butler County were used to defray part of the cost of the survey.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Stripcropping in an area of Kenyon-Clyde-Floyd association.

contents

Index to map units iv
Summary of tables vi
Preface viii
General nature of the county 1
How this survey was made 2
General soil map units 5
Detailed soil map units 17
Prime farmland 68
Use and management of the soils 71
Crops and pasture 71
Woodland management and productivity 74
Windbreaks and environmental plantings 75
Recreation 75
Wildlife habitat 76
Engineering 77
Soil properties 83
Engineering index properties 83
Physical and chemical properties 84
Soil and water features 85
Classification of the soils 87
Soil series and their morphology 87
Formation of the soils 125
References 128
Glossary 131
Tables 139

Soil series

Ackmore series 87
Backbone series 88
Bassett series 89
Bolan series 89
Bremer series 90
Burkhardt series 91
Calco series 91
Chelsea series 92
Clyde series 92
Coland series 93
Colo series 93
Cresco series 94
Dickinson series 95
Dinsdale series 95
Donnan series 96
Downs series 97
Du Page series 97
Ely series 98
Flagler series 99
Floyd series 99
Garwin series 100
Hanska series 100
Hoopeston series 101
Houghton series 101
Kenyon series 102
Klinger series 103
Lamont series 103
Lawler series 104
Lourdes series 105
Marshan series 105
Maxfield series 106
Mt. Carroll series 106
Muscatine series 107
Nevin series 108
Olin series 109
Ostrander series 109
Palms series 110
Protivin series 110
Raddle series 111
Readlyn series 112
Riceville series 112
Rockton series 113
Saude series 114
Schley series 114
Shandep series 115
Sogn series 116
Sparta series 116
Spillville series 117
Tama series 117
Terril series 118
Thorp series 118
Tripoli series 119
Wapsie series 120
Waubeek series 120
Waukee series 121
Waukegan series 122
Winneshiek series 122
Worthen series 123

Issued July 1982

index to map units

11B—Colo-Ely complex, 2 to 5 percent slopes 17
27B—Terril loam, 2 to 5 percent slopes 18
41B—Sparta loamy fine sand, 1 to 5 percent slopes. 19
41C—Sparta loamy fine sand, 5 to 9 percent slopes. 19
41D—Sparta loamy fine sand, 9 to 14 percent slopes 20
43—Bremer silty clay loam, 0 to 2 percent slopes 20
63C—Chelsea loamy fine sand, 2 to 9 percent slopes 20
83B—Kenyon loam, 2 to 5 percent slopes 21
83C—Kenyon loam, 5 to 9 percent slopes 21
83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded 22
83D2—Kenyon loam, 9 to 14 percent slopes, moderately eroded 22
84—Clyde silty clay loam, 0 to 3 percent slopes 23
88—Nevin silty clay loam, 0 to 2 percent slopes 23
109C—Backbone fine sandy loam, 2 to 9 percent slopes 24
110B—Lamont fine sandy loam, 2 to 5 percent slopes 25
110C—Lamont fine sandy loam, 5 to 9 percent slopes 25
118—Garwin silty clay loam, 0 to 2 percent slopes ... 26
119—Muscatine silty clay loam, 1 to 3 percent slopes 26
120—Tama silt loam, 0 to 2 percent slopes 26
120B—Tama silt loam, 2 to 5 percent slopes 27
133—Colo silty clay loam, 0 to 2 percent slopes 27
135—Coland clay loam, 0 to 2 percent slopes 27
150B—Hanska loam, 1 to 4 percent slopes 28
151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes 28
152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes 28
153—Shandep clay loam, 0 to 1 percent slopes 29
162C—Downs silt loam, 5 to 9 percent slopes 29
162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded 29
171—Bassett loam, 0 to 2 percent slopes 30
171B—Bassett loam, 2 to 5 percent slopes 31
171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded 31
171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded 32
171F—Bassett loam, 14 to 25 percent slopes 33
173—Hoopeston fine sandy loam, 0 to 2 percent slopes 33
173B—Hoopeston fine sandy loam, 2 to 5 percent slopes 33
174—Bolan loam, 0 to 2 percent slopes 34
174B—Bolan loam, 2 to 5 percent slopes 34
174C2—Bolan loam, 5 to 9 percent slopes, moderately eroded 35
175—Dickinson fine sandy loam, 0 to 2 percent slopes 35
175B—Dickinson fine sandy loam, 2 to 5 percent slopes 36
175C—Dickinson fine sandy loam, 5 to 9 percent slopes 36
177—Saude loam, 0 to 2 percent slopes 36
177B—Saude loam, 2 to 5 percent slopes 37
177C—Saude loam, 5 to 9 percent slopes 37
178—Waukee loam, 0 to 2 percent slopes 38
178B—Waukee loam, 2 to 5 percent slopes 38
184—Klinger silty clay loam, 1 to 3 percent slopes ... 39
198B—Floyd loam, 1 to 4 percent slopes 39
201B—Coland-Terril complex, 1 to 4 percent slopes. 39
213—Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes 40
213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes 40
214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes 41
214C—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes 41
214C2—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded 41
221B—Palms muck, 2 to 5 percent slopes 42
225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes 42
226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes 42
241C2—Saude-Burkhardt complex, 2 to 9 percent slopes, moderately eroded 44
241E2—Saude-Burkhardt complex, 9 to 18 percent slopes, moderately eroded 44
284—Flagler sandy loam, 0 to 2 percent slopes 45
284B—Flagler sandy loam, 2 to 5 percent slopes 45
284C—Flagler sandy loam, 5 to 9 percent slopes 45
285C—Burkhardt sandy loam, 2 to 9 percent slopes. 46
350—Waukegan silt loam, 0 to 2 percent slopes 46
354—Aquolls, ponded 47
377B—Dinsdale silty clay loam, 2 to 5 percent slopes 47

377C2—Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded 47
382—Maxfield silty clay loam, 0 to 2 percent slopes. 48
391B—Clyde-Floyd complex, 1 to 4 percent slopes .. 48
394—Ostrander loam, 0 to 2 percent slopes 49
394B—Ostrander loam, 2 to 5 percent slopes 49
394C—Ostrander loam, 5 to 9 percent slopes 49
394C2—Ostrander loam, 5 to 9 percent slopes, moderately eroded 50
398—Tripoli silty clay loam, 0 to 2 percent slopes 50
399—Readlyn silty clay loam, 1 to 3 percent slopes . 51
404—Thorp silt loam, 0 to 1 percent slopes 51
407B—Schley silt loam, 1 to 4 percent slopes 51
408B—Olin fine sandy loam, 2 to 5 percent slopes... 52
408C—Olin fine sandy loam, 5 to 9 percent slopes... 52
412C—Sogn loam, 2 to 9 percent slopes 53
412F—Sogn loam, 9 to 30 percent slopes 53
428B—Ely silt loam, 2 to 5 percent slopes 53
430—Ackmore silt loam, 1 to 3 percent slopes 54
457—Du Page loam, 0 to 2 percent slopes 55
485—Spillville loam, 0 to 2 percent slopes 55
585—Spillville-Coland complex, 0 to 2 percent slopes 55
621—Houghton muck, 0 to 2 percent slopes 56
662D—Mt. Carroll silt loam, 9 to 14 percent slopes... 56
662D3—Mt. Carroll silt loam, 9 to 14 percent slopes, severely eroded 56
662F—Mt. Carroll silt loam, 14 to 25 percent slopes. 58
662F3—Mt. Carroll silt loam, 14 to 25 percent slopes, severely eroded 58
713B—Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes 58
714B—Winneshiek loam, 20 to 30 inches to limestone, 2 to 5 percent slopes 59
733—Calco silty clay loam, 0 to 2 percent slopes...... 59
771B—Waubeek silt loam, 2 to 5 percent slopes....... 59
777—Wapsie loam, 0 to 2 percent slopes 60
777B—Wapsie loam, 2 to 5 percent slopes 60
781B—Lourdes loam, 2 to 5 percent slopes 61
781C2—Lourdes loam, 5 to 9 percent slopes, moderately eroded 61
782B—Donnan loam, 2 to 5 percent slopes 62
782C2—Donnan loam, 5 to 9 percent slopes, moderately eroded 63
783B—Cresco loam, 2 to 5 percent slopes 63
783C—Cresco loam, 5 to 9 percent slopes 64
783C2—Cresco loam, 5 to 9 percent slopes, moderately eroded 64
784B—Riceville loam, 1 to 4 percent slopes 65
798B—Protivin clay loam, 1 to 4 percent slopes 65
976—Raddle silt loam, 0 to 2 percent slopes 66
976B—Raddle silt loam, 2 to 5 percent slopes 66
981B—Worthen silt loam, 2 to 5 percent slopes 67
1585—Spillville-Coland complex, channeled, 0 to 2 percent slopes 67
5010—Pits, sand and gravel 67
5030—Pits, limestone 68
5040—Orthents, loamy 68

summary of tables

Temperature and precipitation (table 1) 140

Freeze dates in spring and fall (table 2) 141

Probability. Temperature.

Growing season (table 3) 141

Probability. Daily minimum temperature.

Acreage and proportionate extent of the soils (table 4) 142

Acres. Percent.

Yields per acre of crops and pasture (table 5) 144

Corn. Soybeans. Oats. Kentucky bluegrass. Grass-legume hay. Bromegrass-alfalfa. Smooth bromegrass.

Capability classes and subclasses (table 6) 149

Total acreage. Major management concerns.

Woodland management and productivity (table 7) 150

Ordination symbol. Management concerns. Potential productivity. Trees to plant.

Windbreaks and environmental plantings (table 8) 152

Trees having predicted 20-year average heights.

Recreational development (table 9) 159

Camp areas. Picnic areas. Playgrounds. Paths and trails. Golf fairways.

Wildlife habitat (table 10) 165

Potential for habitat elements. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife.

Building site development (table 11) 170

Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets. Lawns and landscaping.

Sanitary facilities (table 12) 176

Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.

Construction materials (table 13) 182

Roadfill. Sand. Gravel. Topsoil.

Water management (table 14) 187

Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.

Engineering index properties (table 15) 192
Depth. USDA texture. Classification—Unified, AASHTO. Fragments more than 3 inches. Percentage passing sieve—4, 10, 40, 200. Liquid limit. Plasticity index.

Physical and chemical properties of soils (table 16) 199
Depth. Clay. Moist bulk density. Permeability. Available water capacity. Reaction. Shrink-swell potential. Erosion factors. Wind erodibility group. Organic matter.

Soil and water features (table 17) 204
Hydrologic group. Flooding. High water table. Bedrock. Potential frost action. Risk of corrosion.

Classification of the soils (table 18) 209
Family or higher taxonomic class.

preface

This soil survey contains information that can be used in land-planning programs in Butler County, Iowa. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

soil survey of
Butler County, Iowa

By Russell L. Buckner, Soil Conservation Service

Fieldwork by Charles E. Branham, Russell L. Buckner, Ivan J. Jansen, John A. Lucassen, and David E. Preloger, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with
Iowa Agriculture and Home Economics Experiment Station
Cooperative Extension Service, Iowa State University
and the Department of Soil Conservation, State of Iowa

BUTLER COUNTY is in the southeastern part of north-central Iowa (fig. 1). The area of the county is 372,480 acres or 582 square miles.

Allison is the county seat. It is near the center of the county, just north of the junction of State Highways 3 and 4. In 1970, the population of Allison was 1,071. Other towns in Butler County are Clarksville, Greene, Parkersburg, and Shell Rock.

The first soil survey of Butler County was published in 1928 (*11*). This present survey updates the first survey and provides additional information and larger maps that show the soils in greater detail.

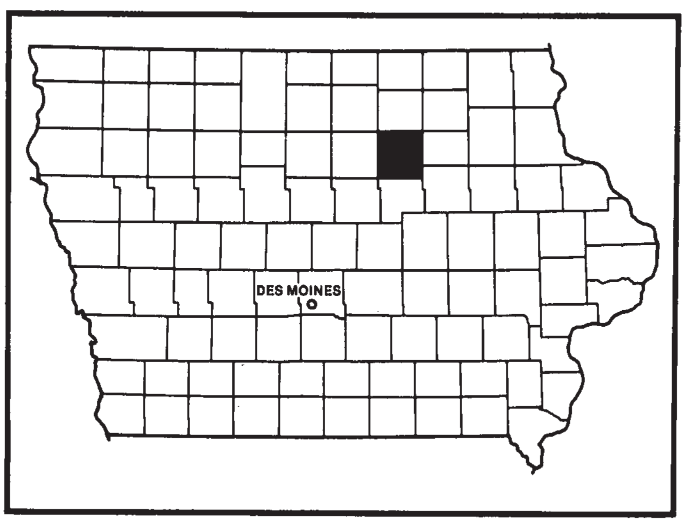


Figure 1.—Location of Butler County in Iowa.

general nature of the county

This section gives general information concerning the county. It discusses the climate; physiography, relief, and drainage; farming; transportation, industry, and markets; and natural resources.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Allison in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 20 degrees F, and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Allison on January 18, 1967, is -31 degrees. In summer the average temperature is 83 degrees, and the average daily maximum temperature is 83.2 degrees. The highest recorded temperature, which occurred on July 30, 1955, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 25 inches. Of this, 74 percent usually falls in April through September, which

includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 7.16 inches at Allison on July 17, 1968. Thunderstorms occur on about 41 days each year, and most occur in summer.

Average seasonal snowfall is 39 inches. The greatest snow depth at any one time during the period of record was 37 inches. On an average of 9 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 84 percent. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in April.

physiography, relief, and drainage

Butler County is on the Middle Western Upland Plains of the Central Lowlands. It is drained by the Shell Rock River, the West Fork of the Cedar River, and Beaver Creek. The Shell Rock River and its tributaries drain about 31 percent of the county, the West Fork of the Cedar River and its tributaries drain about 47 percent, and Beaver Creek and its tributaries drain about 22 percent. A few sections in the northeastern part of the county drain into the Cedar River.

The topography of most of the county is subdued. The slopes are generally long, and a system of drainageways and small streams are well established. The greatest relief is in the southern part of the county, mostly to the north of Beaver Creek. The flood plains and the accompanying nearly level and gently sloping stream benches of the rivers and larger streams are generally broad. In many places along the Shell Rock and West Fork of the Cedar Rivers and in some places along Beaver Creek, the valleys are 1 mile to 2 1/2 miles wide.

The highest altitude, about 1,150 feet, is in Cold Water Township, and the lowest altitude, about 865 feet, is on the flood plain of Beaver Creek at the east edge of the county.

farming

By Dale Thoreson, Cooperative Extension Service, Butler County.

Although the trend in recent years has been toward a decrease in the number of farms in the county, the size of individual farms generally has increased. Livestock farms far outnumber all other types, and most of the crops harvested are consumed by livestock on the farms where the crops are grown.

The county had a total of 1,565 farms in 1974 according to the 1974 Census of Agriculture. In the same year about 347,383 acres were in farms, and the average size of the farms was 222 acres.

Farming is the main economic enterprise in Butler County. The principal crops are corn, soybeans, oats, hay, and pasture. Hogs, beef cattle, and dairying are the principal sources of income.

Except for soybeans, most field crops grown in Butler County are fed to livestock. Some corn is sold as a cash crop, but the amount varies from year to year and depends largely on the price of feeder cattle, the market for hogs, the cash price for corn, and the quality of the corn crop. Although corn is the main grain crop, the acreage in soybeans has increased in the last few years.

transportation, industry, and markets

Federal, State, and county highways through the county provide routes for auto traffic and for the transportation of farm products. United States Highway 20 and Iowa Highway 3 cross the county from east to west, and Iowa Highway 14 crosses the county from north to south. There are many asphalt county roads. Railroads or freight lines serve every trading center. Butler County is primarily devoted to farming, but there are a few small industries.

natural resources

Soil is the most important natural resource in Butler County. Soils on slopes of 5 percent or less cover 75 percent of the county. Livestock that graze the fields and crops produced on farms are marketable products.

The county is abundantly supplied with a variety of natural resources other than productive farm soils. Among these are limestone, gravel, sand, lumber, and glacial boulders.

Limestone is near the surface in several areas. It is used commercially for road building, concrete, and as a source of lime for agronomic uses.

Sand and gravel deposits are on high alluvial terraces adjacent to the major streams and are in some areas on uplands. Many of the areas on uplands are small and have been abandoned or unworked for many years.

Native timber is adjacent to major streams. Wood crops are used for crates and shipping material for manufactured products, construction of buildings, firewood, and various other uses.

Glacial deposits in the county are a good source of boulders. Many buildings have foundations built with glacial boulders. Boulders are used commercially for landscaping, by communities, and by private individuals.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape

of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas called soil associations that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one soil association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Marshan-Coland-Flagler association

Nearly level to moderately sloping, poorly drained and somewhat excessively drained soils that formed in loamy sediment underlain by loamy, sandy, or gravelly alluvial sediment; on stream benches and bottom lands

This association consists mainly of soils on wide benches and bottom lands (fig. 2). In places soils are on the side slopes of the stream benches. The stream benches are free from flooding, except in the lowest parts. Most areas of the bottom lands are susceptible to flooding. Some parts of bottom lands have too many channels to be suited to row crops. About 58 percent of this association is on stream benches, and 42 percent is on bottom lands. Slope ranges from 0 to 9 percent.

This association makes up about 24 percent of the county. It is 20 percent Marshan soils, 18 percent Coland soils, 8 percent Flagler soils, and 54 percent soils of minor extent.

The poorly drained, nearly level to slightly depressional Marshan soils are on stream benches. The poorly drained, nearly level Coland soils are on low, channeled flood plains adjacent to the major streams. The somewhat excessively drained, level to moderately sloping Flagler soils are on the high parts of stream benches.

Typically, the surface layer of the Marshan soils is black clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is very dark gray, friable clay loam; the middle part is grayish brown and olive gray, mottled, friable clay loam; and the lower part is grayish brown, mottled, very friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled loamy sand in the upper part and multicolored coarse sand in the lower part.

Typically, the surface layer of the Coland soils is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 34 inches thick. The substratum to a depth of about 66 inches is stratified very dark gray, mottled sandy clay loam and sandy loam.

Typically, the surface layer of the Flagler soils is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is brown, very friable sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown loamy sand.

Of minor extent on benches are the Hoopeston, Lawler, Raddle, Saude, and Waukee soils. On bottom lands are the Colo, Du Page, and Spillville soils. The somewhat poorly drained Hoopeston and Lawler soils are nearly level. The well drained Saude soils are nearly level to moderately sloping and have less sand in the surface layer and upper part of the subsoil than the Flagler soils. The well drained Raddle and Waukee soils are nearly level and gently sloping. The poorly drained Colo, moderately well drained Du Page, and moderately well drained and somewhat poorly drained Spillville soils are nearly level.

Most areas of this association are used for row crops, except the frequently flooded bottom lands. The soils are poorly suited to well suited to row crops. Corn, soybeans, and small grains are grown, and grasses and legumes are grown for hay and pasture. The available water capacity ranges from low to very high.

The concerns of management are variable. Some areas need flood control and drainage improvement; other areas need control of wind and water erosion. Some areas are droughty. The soils on benches are the most extensive sources of sand and gravel in the county.

2. Cresco-Kenyon-Clyde association

Nearly level to strongly sloping, moderately well drained and poorly drained soils that formed in loamy sediment and the underlying glacial till; on uplands

This association consists of soils on broad ridge

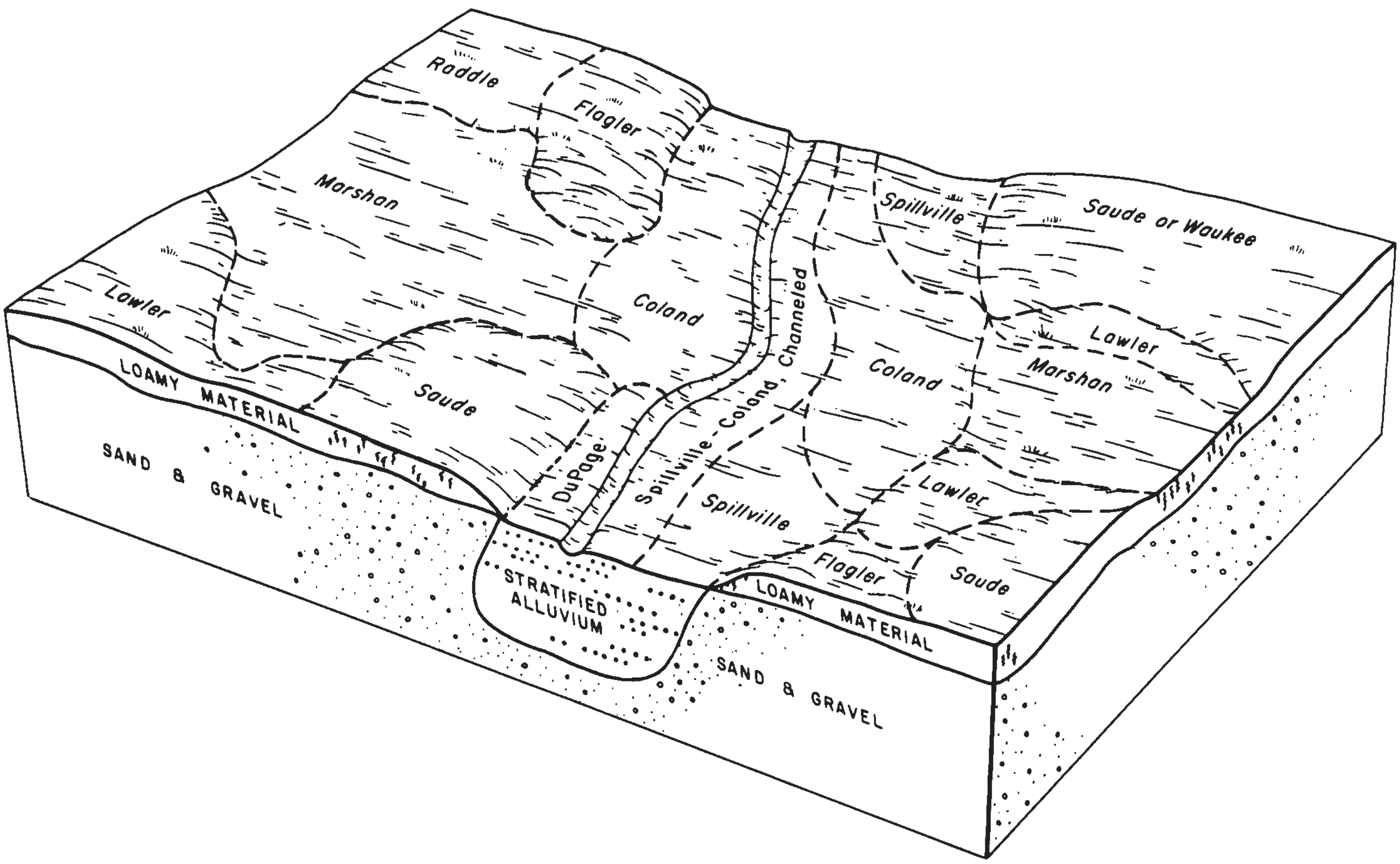


Figure 2.—Typical pattern of soils and parent material in the Marshan-Coland-Flagler association.

crests, side slopes, and foot slopes and along streams and drainageways (fig. 3). The steeper soils are generally close to the larger streams and rivers. Slope ranges from 0 to 14 percent.

This association makes up about 6 percent of the county. It is about 27 percent Cresco soils, 18 percent Kenyon soils, 15 percent Clyde soils, and 40 percent soils of minor extent.

The moderately well drained, gently sloping and moderately sloping Cresco soils are on the higher, more sloping part of the landscape but are generally at a slightly lower elevation than the moderately well drained, gently sloping to strongly sloping Kenyon soils. The poorly drained, nearly level Clyde soils are in drainageways, on lower concave slopes, and at heads of drainageways.

Typically, the surface layer of the Cresco soils is black loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 72 inches is yellowish brown and gray, very firm, calcareous clay loam.

Typically, the surface layer of the Kenyon soils is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 66 inches is yellowish brown, mottled, firm, calcareous loam.

Typically, the surface layer of the Clyde soils is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam and very dark gray clay loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, mottled, friable clay loam; the middle part is light olive brown, mottled, friable loam; and the lower part is yellowish brown, mottled, very friable sandy loam. The substratum to a depth of about 72 inches is distinctly mottled. The upper part is yellowish brown sandy clay loam stratified

with gray loam; the middle part is pale brown loamy sand; and the lower part is strong brown loam.

Of minor extent are Donnan, Floyd, Ostrander, Protivin, and Riceville soils. The somewhat poorly drained and moderately well drained Donnan soils typically are on downslope ridge crests and side slopes. Donnan soils have more clay in the subsoil than the major soils. The somewhat poorly drained Floyd soils are on low concave slopes adjacent to drainageways. The well drained Ostrander soils are on landscape positions similar to those of Kenyon soils. Somewhat poorly drained Protivin and Riceville soils are on low, slightly convex to slightly concave side slopes. In places, the Protivin soils are adjacent to drainageways.

Nearly all areas of this association are used intensively for row crops. Corn, soybeans, and small grains are grown. The soils are moderately suited to well suited to row crops. Available water capacity in most of the soils is high.

The main concerns of management are controlling water erosion, improving drainage, and maintaining good tilth and fertility. Because of the high density of the subsoil in the Cresco, Donnan, Protivin, and Riceville soils, tile drains do not function well in all areas of these soils. Closer tile spacing may be needed in these soils than in the Clyde and Floyd soils.

3. Dickinson-Sparta association

Nearly level to strongly sloping, well drained to excessively drained soils that formed in loamy and sandy material; on uplands

This association consists of soils on ridge crests, side slopes, and foot slopes (fig. 4). The strongly sloping soils are generally close to the larger streams and rivers. Slope ranges from 0 to 14 percent.

This association makes up about 9 percent of the county. It is about 24 percent Dickinson soils, 17 percent Sparta soils, and 59 percent soils of minor extent.

The well drained and somewhat excessively drained Dickinson soils and the excessively drained Sparta soils are on similar positions on the landscape. Most of the gently sloping and moderately sloping soils are on narrow ridge crests and convex side slopes.

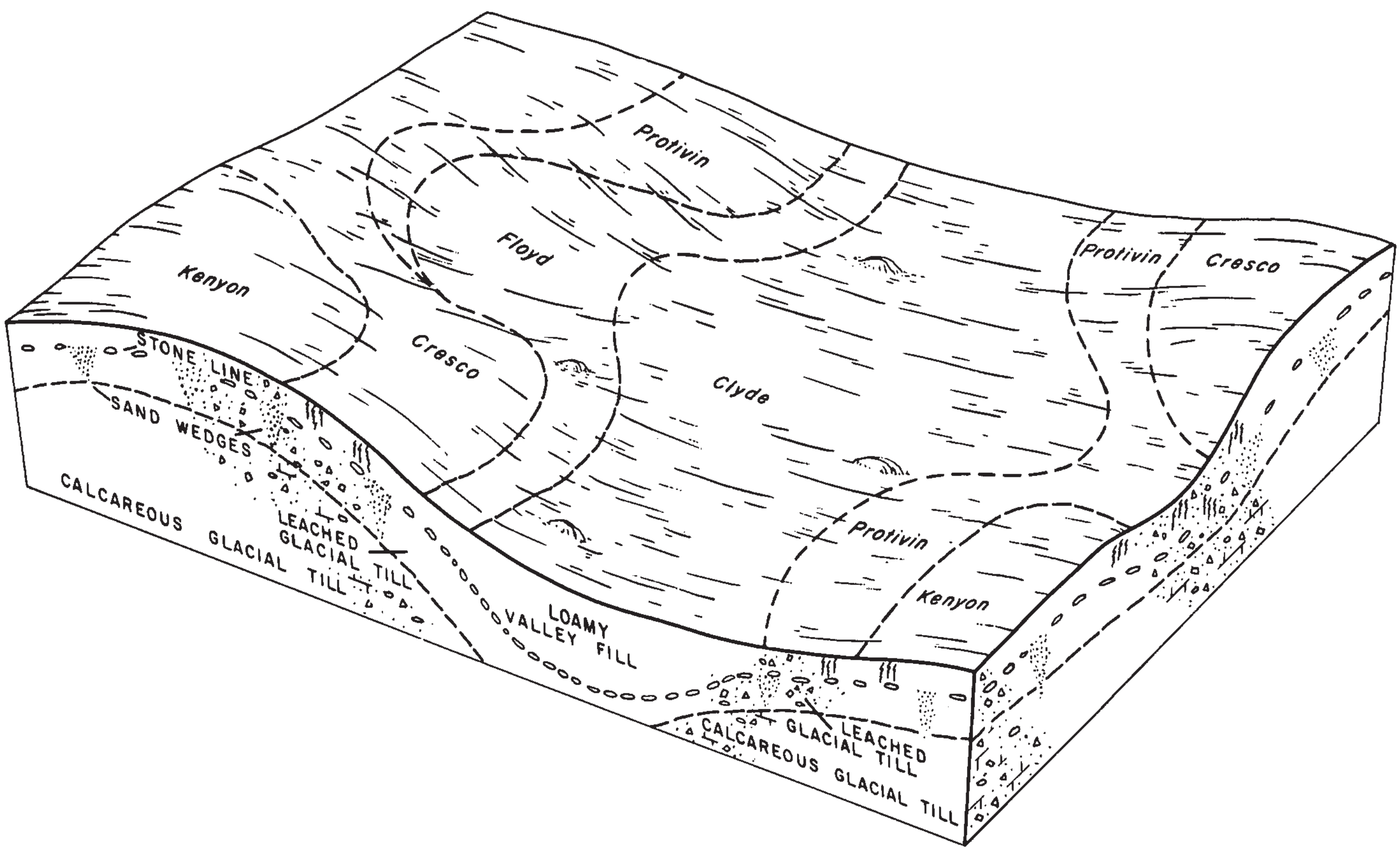


Figure 3.—Typical pattern of soils and parent material in the Cresco-Kenyon-Clyde association.

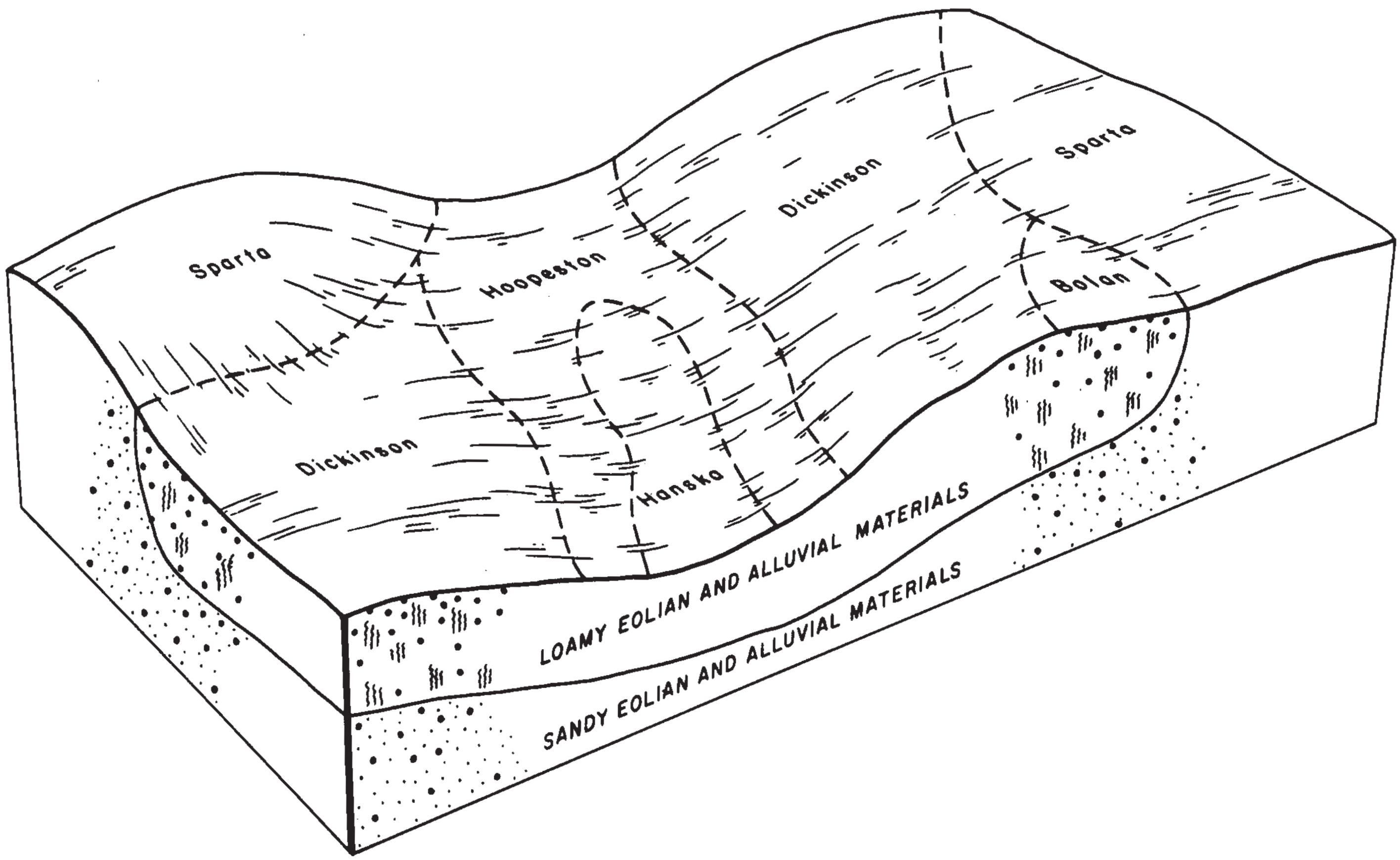


Figure 4.—Typical pattern of soils and parent material in the Dickinson-Sparta association.

Typically, the surface layer of the Dickinson soils is very dark brown fine sandy loam about 8 inches thick. The subsurface layer is very dark brown fine sandy loam about 9 inches thick. The subsoil is dark yellowish brown, very friable fine sandy loam about 14 inches thick. The substratum to a depth of about 72 inches is dark yellowish brown and brown loamy sand.

Typically, the surface layer of the Sparta soils is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 11 inches thick. The subsoil is brown, very friable loamy fine sand about 19 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown loamy sand.

Of minor extent are Bolan, Clyde, Floyd, Hanska, Hoopeston, Lawler, Olin, Ostrander, and Marshan soils. The well drained Bolan soils are on landscape positions similar to those of Dickinson soils. The poorly drained Clyde, Hanska, and Marshan soils are in drainageways, on lower concave slopes, and at the heads of drainageways on uplands. The somewhat poorly drained Floyd, Hoopeston, and Lawler soils are on lower, slightly concave slopes adjacent to drainageways. The well drained and somewhat excessively drained Olin soils and the well drained Ostrander soils are on ridge crests and convex side slopes. Bolan and Olin soils have coarser texture in the subsoil and substratum than the major soils.

Many areas of this association are used for row crops. The soils are poorly suited or moderately suited to row crops. Corn, soybeans, and small grains are grown, and grasses and legumes are grown for hay and pasture. The available water capacity is moderate or low.

The main concerns of management are controlling water and wind erosion and improving fertility. The sandy soils in this association are droughty and low in fertility.

4. Dinsdale-Klinger-Maxfield association

Nearly level to moderately sloping, well drained, somewhat poorly drained, and poorly drained soils that formed in loess and the underlying glacial till; on uplands

This association consists of soils on broad ridge

crests, on side slopes, and along drainageways (fig. 5). Slope ranges from 0 to 9 percent.

This association makes up about 13 percent of the county. It is about 25 percent Dinsdale soils, 17 percent Klinger soils, 8 percent Maxfield soils, and 50 percent soils of minor extent.

The well drained, gently sloping and moderately sloping Dinsdale soils are on the higher, more sloping parts of the landscape. The somewhat poorly drained, nearly level and gently sloping Klinger soils are on ridge crests and side slopes. The poorly drained, nearly level Maxfield soils are on broad ridge crests and along drainageways on uplands.

Typically, the surface layer of the Dinsdale soils is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, very friable sandy loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 73 inches is yellowish brown, mottled loam.

Typically, the surface layer of the Klinger soils is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Typically, the surface layer of the Maxfield soils is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is about 25 inches thick. The upper part is olive gray and olive brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, calcareous loam.

Of minor extent are Bolan, Clyde, Kenyon, and Rockton soils. The poorly drained Clyde soils are in drainageways and on lower concave slopes. They are lower on the landscape than Maxfield soils and have more sand in the substratum. The moderately well drained Kenyon soils are on landscape positions similar

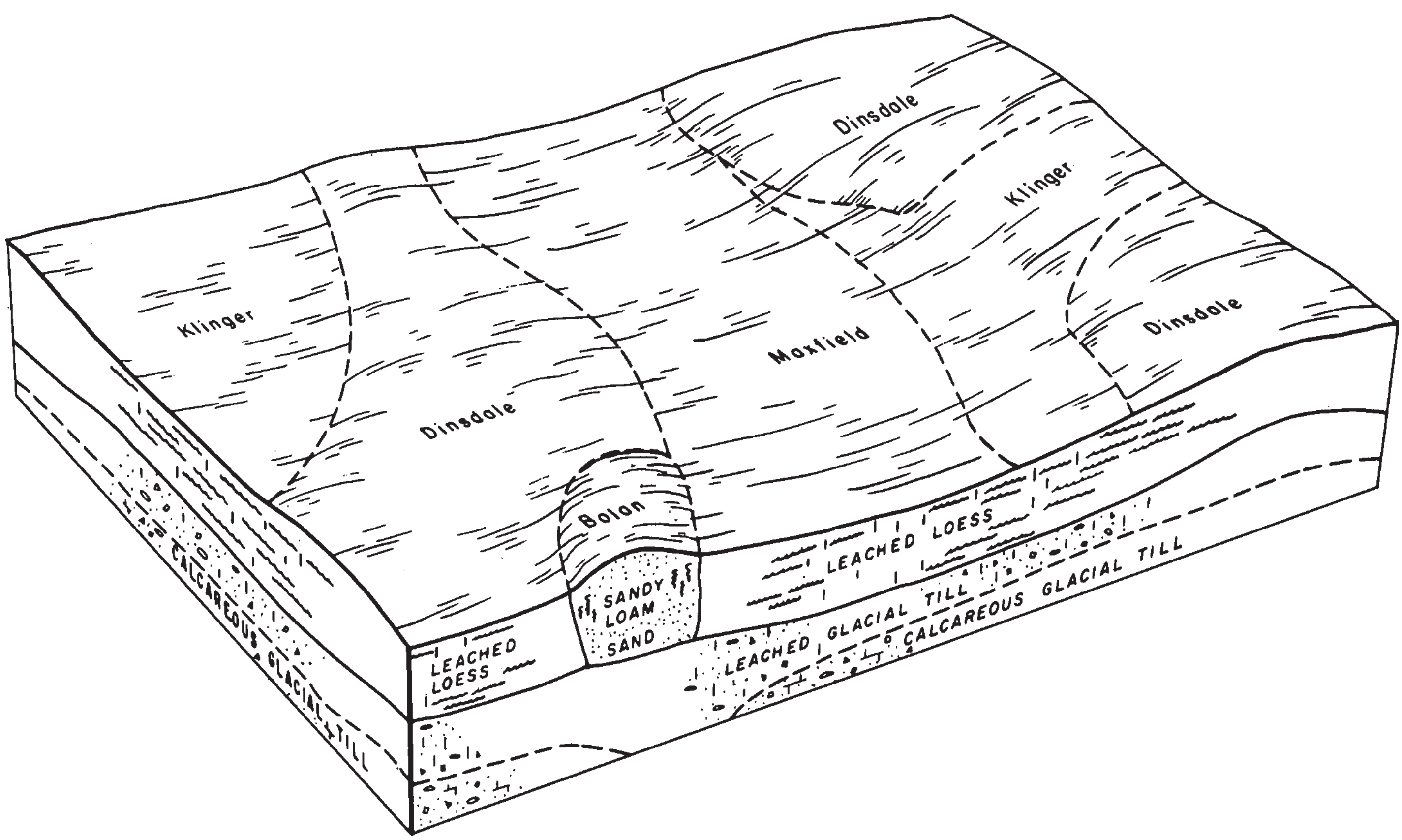


Figure 5.—Typical pattern of soils and parent material in the Dinsdale-Klinger-Maxfield association.

to those of Dinsdale soils. The well drained Rockton soils are on nearly level to moderately sloping ridge crests and side slopes and are generally on the lower parts of the landscape. The Rockton soils are moderately deep to limestone bedrock.

Nearly all areas of this association are used intensively for row crops. Corn, soybeans, and small grains are grown. The soils are well suited to cultivated crops.

The main management concerns are erosion control on the sloping soils and tile drainage of the wet soils.

5. Mt. Carroll-Downs-Garwin association

Nearly level to steep, well drained and poorly drained soils that formed in loess; on uplands

This association consists of soils on ridge crests and convex side slopes and of less sloping soils along narrow drainageways, on foot slopes, and on broad upland divides (fig. 6). Slope ranges from 0 to 25 percent.

This association makes up about 4 percent of the county. It is about 19 percent Mt. Carroll soils, 16 percent Downs soils, 16 percent Garwin soils, and 49 percent soils of minor extent.

The well drained, strongly sloping to steep Mt. Carroll soils are on narrow ridge crests and side slopes. The well drained, moderately sloping Downs soils are on convex ridge crests and side slopes. The poorly drained, level Garwin soils are on broad ridge crests and at heads of drainageways.

Typically, the surface layer of the Mt. Carroll soils is very dark gray silt loam about 7 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is dark yellowish brown, friable silt loam about 27 inches thick. The mottled substratum to a depth of about 72 inches is dark yellowish brown and light olive gray, calcareous silt loam.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown, friable silt loam. The

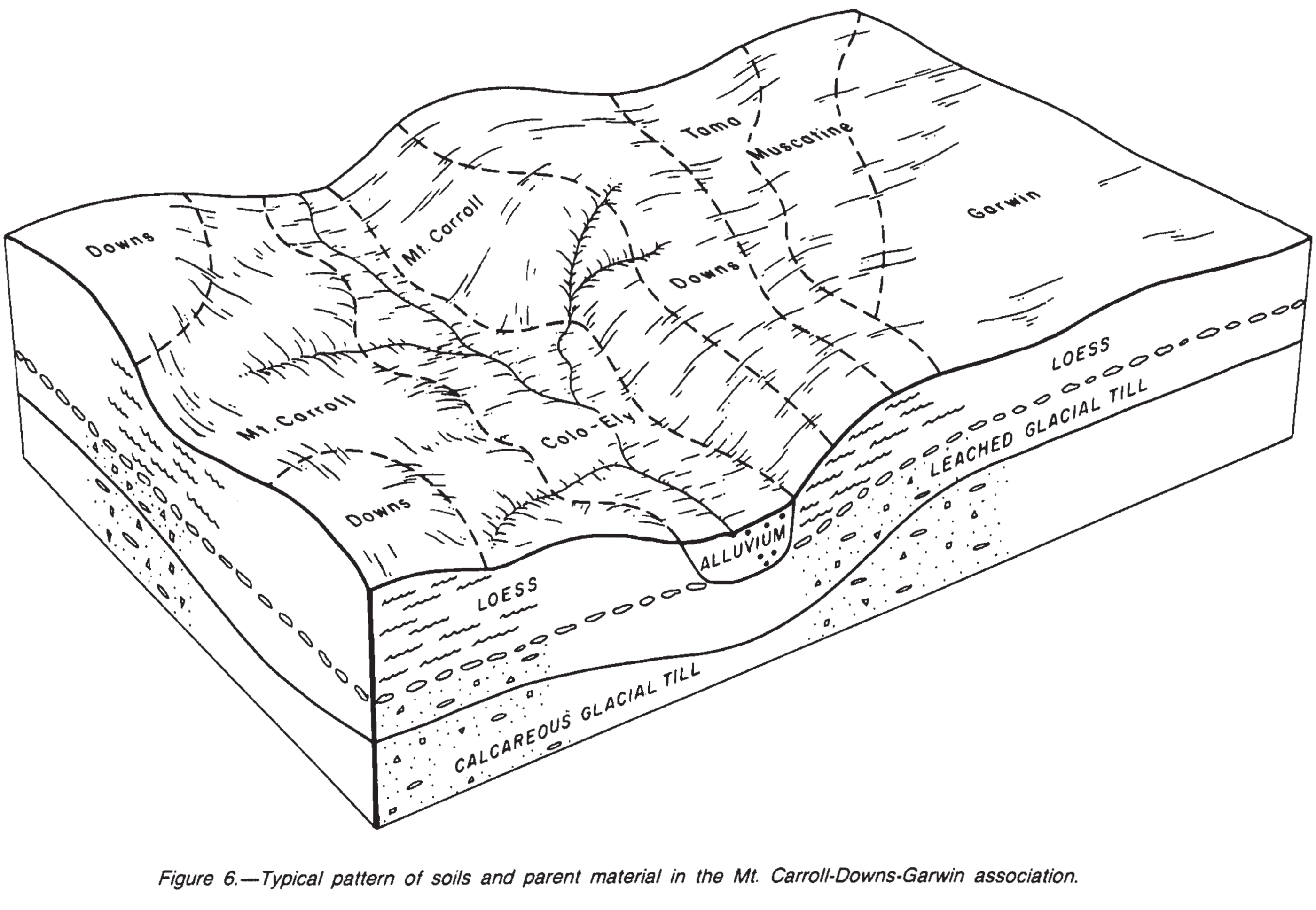


Figure 6.—Typical pattern of soils and parent material in the Mt. Carroll-Downs-Garwin association.

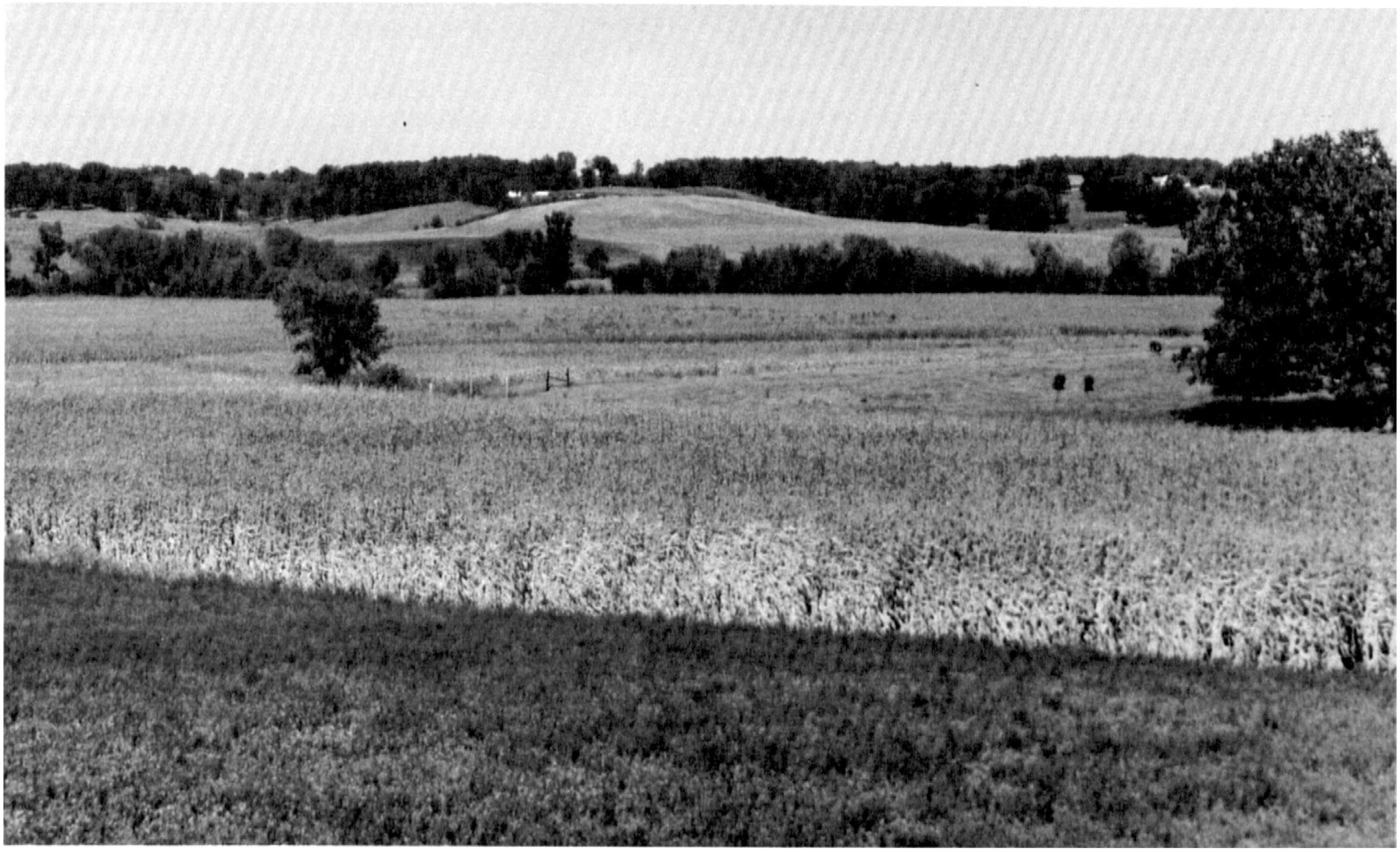


Figure 7.—Typical landscape in Mt. Carroll-Downs-Garwin association. Highly productive Ely and Worthern soils are in the foreground. Mt. Carroll and Downs soils are in the background.

substratum to a depth of about 64 inches is dark yellowish brown, friable silt loam.

Typically, the surface layer of the Garwin soils is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray clay loam about 14 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, mottled, friable silty clay loam; the middle part is olive gray, mottled, friable silty clay loam; and the lower part is olive gray and light olive brown, mottled silty clay loam. The substratum to a depth of about 72 inches is dark grayish brown and dark yellowish brown, mottled sandy loam that is underlain by yellowish brown and strong brown, mottled, calcareous loam.

Of minor extent are Colo, Ely, Muscatine, Tama, and Worthen soils. The poorly drained Colo soils are along drainageways on narrow flood plains and in many places are associated with Ely soils. The Colo and Worthen soils have a thicker, darker surface layer than the major soils. The somewhat poorly drained Ely soils are on concave, lower foot slopes and in many places are associated with Colo soils. The somewhat poorly drained Muscatine soils are on broad, slightly convex, nearly level and very gently sloping ridge crests and side slopes. The well drained Tama soils are on nearly level and gently sloping, lower lying ridge crests and side slopes. Tama soils have a darker colored surface layer than Downs soils. The well drained Worthen soils are on nearly plane and slightly convex foot slopes and convex alluvial fans.

Many areas of this association are used for row crops (fig. 7). The soils are moderately suited to well suited to row crops. Corn, soybeans, and small grains are grown, and grasses and legumes are grown for hay and pasture. Available water capacity is high or very high.

The main concerns of management are controlling erosion, improving drainage in the poorly drained Garwin soils, and maintaining good tilth and fertility.

6. Kenyon-Clyde-Floyd association

Nearly level to strongly sloping, moderately well drained to poorly drained soils that formed in loamy sediment and the underlying glacial till; on uplands

This association consists of soils on broad ridge crests, upland side slopes, and foot slopes along

streams and drainageways (fig. 8). The steeper slopes are generally close to the larger streams and rivers. Slope ranges from 0 to 14 percent.

This association makes up about 41 percent of the county. It is about 28 percent Kenyon soils, 21 percent Clyde soils, 21 percent Floyd soils, and 30 percent soils of minor extent.

The moderately well drained, gently sloping to strongly sloping Kenyon soils are on short, convex side slopes. The poorly drained, nearly level and gently sloping Clyde soils are in upland drainageways, and areas generally contain granite stones and boulders. The somewhat poorly drained, nearly level and gently sloping Floyd soils generally are on concave foot slopes between Kenyon soils and Clyde soils.

Typically, the surface layer of the Kenyon soils is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 66 inches is yellowish brown, mottled, firm, calcareous loam.

Typically, the surface layer of the Clyde soils is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam and very dark gray, mottled clay loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, mottled, friable clay loam; the middle part is light olive brown, mottled, friable loam; and the lower part is yellowish brown, mottled, very friable sandy loam. The substratum to a depth of about 72 inches is stratified and distinctly mottled. The upper part is yellowish brown sandy clay loam and pale brown loamy sand, and the lower part is strong brown loam.

Typically, the surface layer of the Floyd soils is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 15 inches thick. The subsoil is about 32 inches thick. The upper part is olive brown, mottled, friable loam; the middle part is light olive brown, mottled, very friable sandy loam; and the lower part is yellowish brown and grayish brown, mottled,

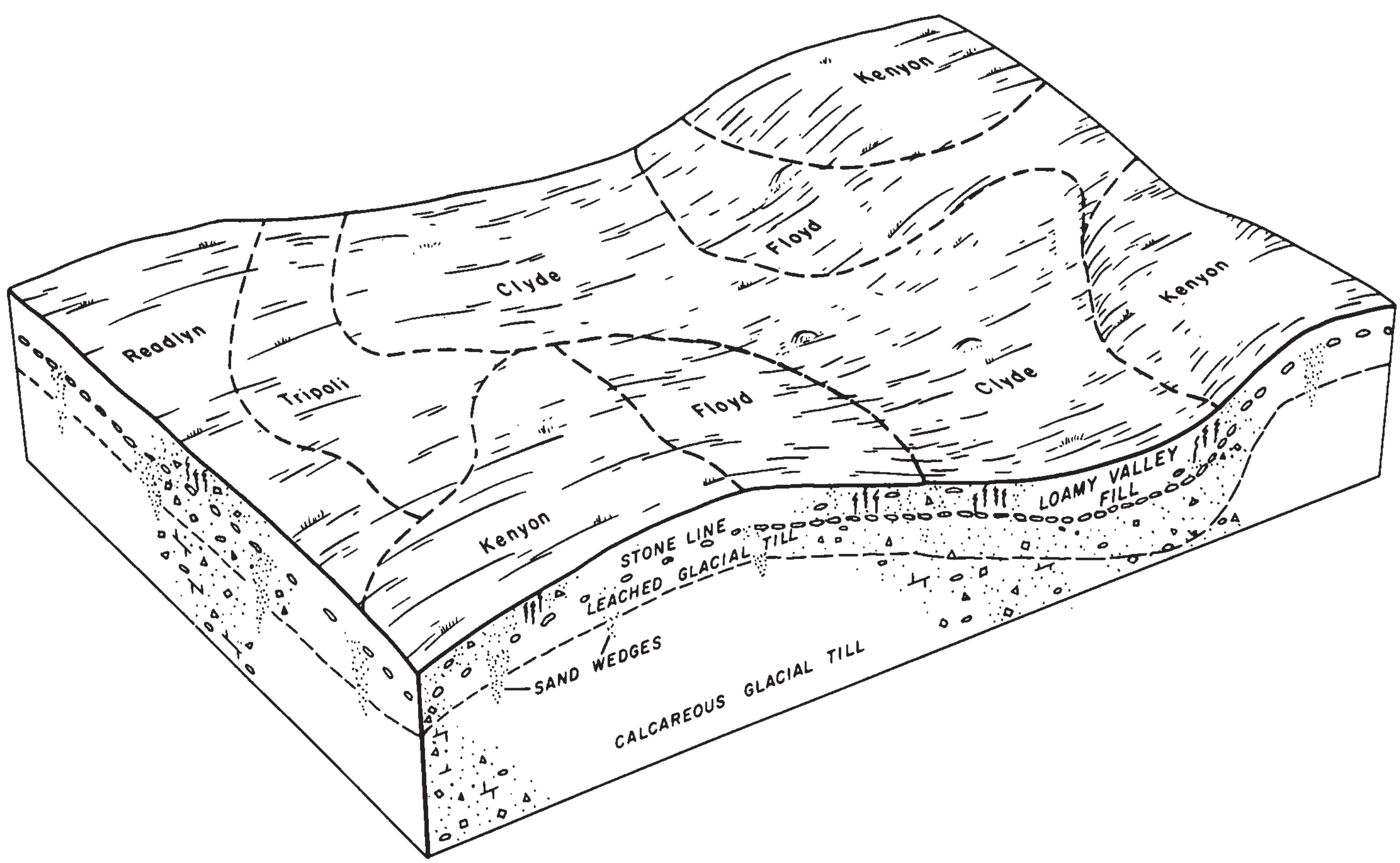


Figure 8.—Typical pattern of soils and parent material in the Kenyon-Clyde-Floyd association.

Figure 9.—Typical landscape in Kenyon-Clyde-Floyd association. The moderately well drained Kenyon soils and the somewhat poorly drained Floyd soils are highly productive. Clyde soils are also highly productive if they are properly tile drained.

firm loam. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, mottled loam.

Of minor extent are Bassett, Dickinson, Donnan, Olin, Ostrander, Protivin, Readlyn, and Tripoli soils. The moderately well drained Bassett soils are on the same landscape positions as Kenyon soils. The well drained and somewhat excessively drained Dickinson and Olin soils are on ridge crests and side slopes. The somewhat poorly drained and moderately well drained Donnan soils typically are on ridge crests and side slopes downslope from Kenyon soils and have more clay in the subsoil than Kenyon soils. The well drained Ostrander soils typically are on lower, convex ridge crests and side slopes. The somewhat poorly drained Protivin soils are on lower, slightly convex to slightly concave slopes and are generally close to drainageways. Protivin soils have more clay in the subsoil than Floyd soils. The somewhat poorly drained Readlyn soils are at a high elevation on broad ridge crests and slightly convex side slopes. The poorly drained Tripoli soils are at a high elevation on broad ridge crests and at the head of drainageways. Tripoli soils have a finer textured subsoil than the major soils.

Nearly all areas of this association are used for row crops (fig. 9). Corn, soybeans, and small grains are suited, and grasses and legumes are grown for hay and pasture. Unimproved areas of Clyde soils are in pastureland. Available water capacity is high in most of the soils. If the plow layer is not eroded, the content of organic matter is high. Potential production of the soils is high.

The main concerns of management are controlling water erosion, improving soil drainage, and maintaining good tilth and fertility.

7. Rockton-Ostrander association

Nearly level to moderately sloping, well drained soils that formed in loamy sediment and the underlying glacial till and limestone residuum; on uplands

This association consists of soils on ridge crests and upland side slopes (fig. 10). Slope ranges from 0 to 9 percent.

This association makes up about 3 percent of the county. It is about 48 percent Rockton soils, 30 percent Ostrander soils, and 22 percent soils of minor extent.

The well drained, level to moderately sloping Rockton and Ostrander soils are on ridge crests and side slopes. Rockton soils are generally at a lower elevation than Ostrander soils.

Typically, the surface layer of the Rockton soils is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is dark brown, friable loam; the middle part is dark yellowish brown, friable sandy clay loam and yellowish brown, firm clay loam; and the lower part is brown, very firm silty clay. The subsoil is underlain by hard, level bedded, shattered limestone bedrock.

Typically, the surface layer of the Ostrander soils is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable loam; the middle part is brown and yellowish brown, friable sandy clay loam and sandy loam; and the lower part is brown, firm loam. The substratum to a depth of about 72 inches is stratified and mixed, strong brown and grayish brown sandy clay loam and clay loam.

Of minor extent are Kenyon and Sogn soils. The moderately well drained Kenyon soils are on ridge crests and side slopes. They are generally at a slightly higher elevation than Ostrander and Rockton soils. The somewhat excessively drained Sogn soils are on gently sloping and moderately sloping, narrow ridge crests and moderately sloping to very steep, short side slopes.

Most areas of this association are used for row crops. The soils are moderately suited or well suited to row crops. Corn, soybeans, and small grains are grown, and grasses are grown for hay and pasture. In years of normal or below normal rainfall, the Rockton soils are susceptible to droughtiness. The available water capacity is high in Ostrander soils and moderate or low in Rockton soils.

The main concerns of management are controlling water erosion and maintaining good tilth and fertility.

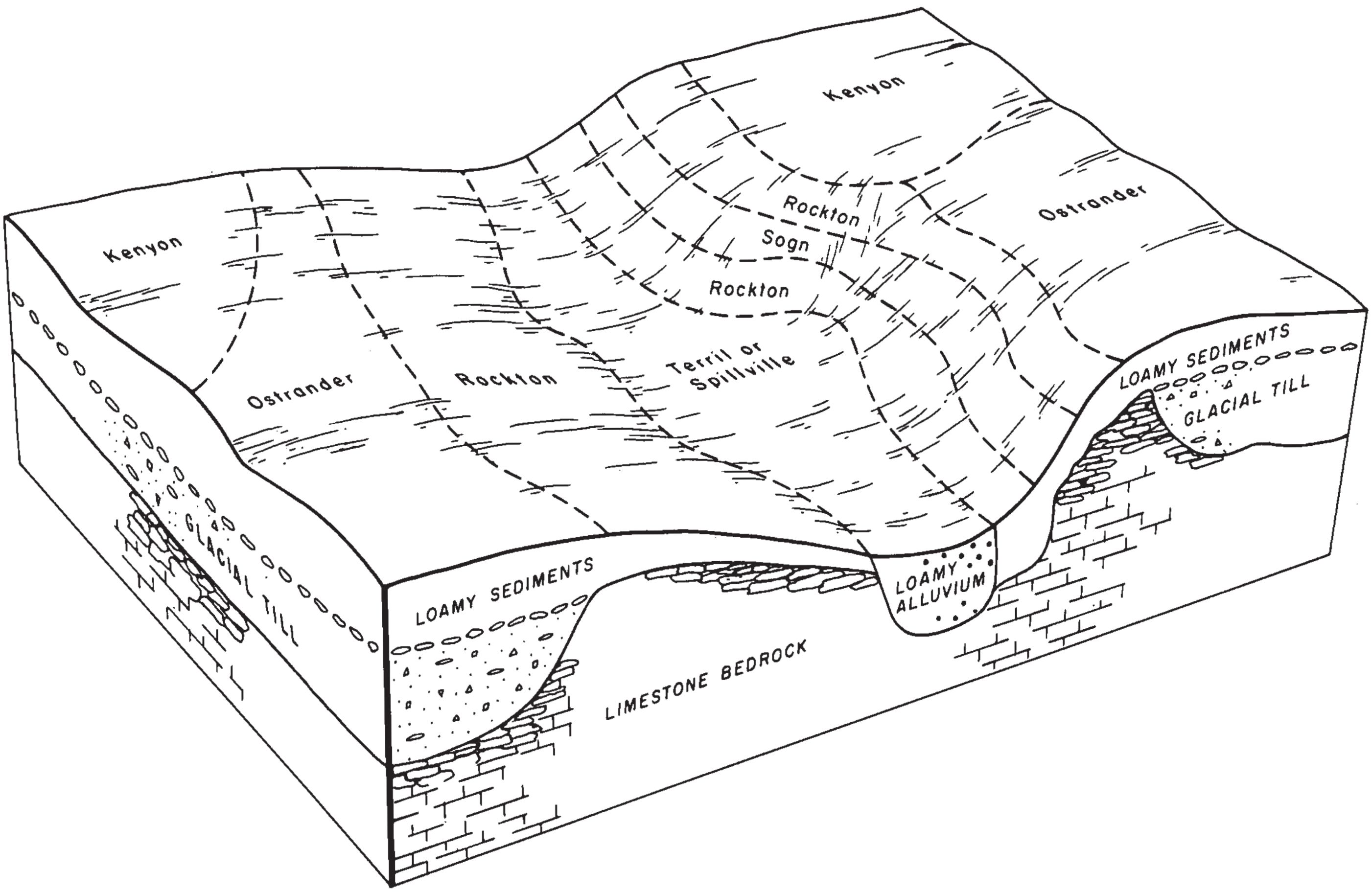


Figure 10.—Typical pattern of soils and parent material in the Rockton-Ostrander association.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kenyon loam, 2 to 5 percent slopes, is one of several phases in the Kenyon series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Clyde-Floyd complex, 1 to 4 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, limestone, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

11B—Colo-Ely complex, 2 to 5 percent slopes. This complex consists of gently sloping, poorly drained and somewhat poorly drained soils on narrow flood plains and foot slopes on uplands (fig. 11). Individual areas are generally long and narrow and range from 3 to 30 acres. About 50 percent of this complex is Colo soils, and 40 percent is Ely soils. Colo soils are along the drainageways, and Ely soils are on the foot slopes. The Colo soils are subject to flooding.

Typically, the surface layer of the Colo soil is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 43 inches thick. It is mottled in the lower part. The mottled substratum to a depth of about 72 inches is olive gray silty clay loam and light olive gray silt loam.

Typically, the surface layer of the Ely soil is black silt loam about 8 inches thick. The subsurface layer is about 29 inches thick. It is brown silt loam in the upper part and very dark grayish brown silty clay loam in the lower part. The subsoil is about 20 inches thick. The upper part is brown and very dark grayish brown, friable silty clay loam with a few dark grayish brown mottles. The lower part is olive brown, friable silty clay loam with strong brown mottles. The substratum to a depth of about 74 inches is grayish brown silt loam with a few olive mottles.

Included with these soils in mapping are areas of Ackmore silt loam in narrow drainageways. The Ackmore soils have less organic matter than Colo and Ely soils. The included soils make up less than 10 percent of mapped areas.

The soils in this complex have very high or high available water capacity and are moderately permeable. They have a seasonal high water table. Runoff is

Figure 11.—Nearly level and gently sloping Colo and Ely soils in the foreground and strongly sloping to steep Mt. Carroll soils in the background. Much of the acreage of these soils in the eastern part of the county is in woodland or pasture.

medium, and the soils receive runoff and seepage from adjacent slopes. Organic matter content in the surface layer of the Colo soils is about 5 to 7 percent and in the Ely soils is about 5 or 6 percent. Typically, reaction is neutral in the surface layer of both soils. These soils are low in available phosphorus and potassium. They have good tilth.

Most areas of these soils are used for cultivated crops. This complex is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available.

If this complex is used for cultivated crops, gully erosion is a hazard. Conservation tillage, which leaves crop residue on the surface, and grassed waterways help to prevent gullies. Interceptor tile helps to remove the excess seepage from adjacent slopes. Where runoff concentrates, areas are subject to gully erosion. Diversion terraces are needed in these areas to intercept runoff. Returning crop residue and not tilling when the soils are wet helps maintain good tilth. Overgrazing pasture or grazing when the soils are wet causes surface compaction and poor tilth.

This complex is in capability subclass IIw.

27B—Terril loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on plane or slightly concave foot slopes and on convex alluvial fans on the uplands. Individual areas are irregular in shape and range from 2 to 10 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 24 inches thick. The subsoil, to a depth of about 60 inches, is dark brown, friable clay loam in the upper part and dark yellowish brown, friable loam in the lower part. In places, yellowish brown, loose loamy sand is between depths of 45 and 60 inches.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium, and this soil receives some runoff. Content of organic matter in the surface layer is about 4 or 5 percent. The reaction is slightly acid or neutral in the surface layer,

depending on past liming practices. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is in capability subclass IIe.

41B—Sparta loamy fine sand, 1 to 5 percent slopes. This nearly level and gently sloping, excessively drained soil is on upland ridges and side slopes and on stream benches. Individual areas are irregular in shape and range from 3 to 30 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 11 inches thick. The subsoil is brown, very friable loamy fine sand about 19 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown loamy sand.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hoopeston soils that are less sloping than this Sparta soil and are near drainageways. The included soils make up less than 5 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Content of organic matter in the surface layer is about 1 percent. The reaction of the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid and is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil are used for cultivated crops, but a few areas are in pastureland or are wooded. This soil is moderately suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Crop production depends on the amount and timeliness of rainfall. Soil blowing and water erosion are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, but most wooded areas are limited to groves and trees around farmsteads. Survival of natural or planted seedlings is a concern. Because of this, seedlings should be planted closely together and should be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This soil is in capability subclass IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on upland ridges and side slopes and on stream benches. Individual areas are irregular in shape and range from 3 to 30 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 7 inches thick. The subsoil is brown, very friable loamy fine sand about 19 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown loamy sand.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hoopeston soils that are less sloping than this Sparta soil and are near drainageways. The included soils make up less than 4 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid to rapid. Surface runoff is slow. Content of organic matter in the surface layer is about 1 percent. The reaction of the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid and is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil are used for cultivated crops. A few areas are in pastureland or are wooded. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture because it is droughty. Crop production depends on the amount and timeliness of rainfall. Water erosion and soil blowing are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation,

timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, but most wooded areas are limited to groves and trees around farmsteads. Survival of natural or planted seedlings is a concern. Because of this, seedlings should be planted closely together and should be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This soil is in capability subclass IVs.

41D—Sparta loamy fine sand, 9 to 14 percent slopes. This strongly sloping, excessively drained soil is on upland ridges and side slopes and on stream benches. Individual areas are irregular in shape and range from 3 to 30 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy sand about 5 inches thick. The subsoil is brown and yellowish brown, loose loamy sand about 10 inches thick. The substratum to a depth of about 60 inches is brown sand. In places, the very dark grayish brown surface layer is less than 6 inches thick.

This soil has low available water capacity. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Content of organic matter in the surface layer is about 1 percent. The reaction of the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid and is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil are used for cultivated crops. A few areas are in pastureland or are wooded. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture because it is droughty. Crop production depends on the amount and timeliness of rainfall. Water erosion and soil blowing are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces are difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep pasture and soil in good condition.

This soil is moderately suited to trees, but wooded areas are limited mainly to groves and trees around farmsteads. Survival of natural or planted seedlings is a concern. Because of this, seedlings should be spaced closely together when planting and should be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This soil is in capability subclass VIs.

43—Bremer silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low stream benches and along drainageways that extend a short distance into the uplands. It is subject to flooding. Individual areas are irregular in shape and range from 4 to 40 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 13 inches thick. The subsoil is about 23 inches thick. The upper part is very dark gray, mottled, friable silty clay loam; and the lower part is olive gray, mottled, friable silty clay loam. The substratum to a depth of about 64 inches is light olive gray and gray silty clay loam and silt loam. In places, carbonates are below a depth of about 40 inches. In a few places, sandy loam and sand are below a depth of 40 inches.

This soil has high available water capacity. It has a seasonal high water table. Permeability is moderately slow. Surface runoff is slow. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction is slightly acid or neutral. This soil has good tilth.

Most areas of this soil are drained by tile and used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains generally work well if good outlets are available. Not tilling when the soil is wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet causes surface compaction and poor tilth.

This soil is moderately suited to trees, and a few areas remain in native hardwoods. The use of equipment needs to be restricted to dry periods or to winter when the ground is frozen; however, special high flotation equipment can be used for harvesting or management during wet periods if needed. Survival of natural and planted seedlings is a concern. Seedlings should be spaced closely together when planting and should be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. Erosion is not a limiting factor on this soil during logging and related road construction.

This soil is in capability subclass IIw.

63C—Chelsea loamy fine sand, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on upland ridges and side

slopes and on stream benches. Individual areas are irregular in shape and range from 5 to 15 acres.

Typically, the surface layer is brown, very friable loamy fine sand about 8 inches thick. The subsurface layer is dark yellowish brown loamy fine sand about 25 inches thick. Below the subsurface layer is brown, loose loamy fine sand to a depth of 70 inches.

This soil has low available water capacity and is rapidly permeable. Surface runoff is slow. Content of organic matter in the surface layer is about 0.5 to 1 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. Reaction below the surface layer is medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil are used for cultivated crops. A few areas are in pastureland or are wooded. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture because it is droughty. Crop production depends on the amount and timeliness of rainfall. Water erosion and soil blowing are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, but wooded areas are mainly limited to groves and trees around farmsteads. Survival of natural and planted seedlings is a concern. To overcome this, seedlings should be spaced closely together when planting and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This soil is in capability subclass IVs.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, smooth, slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 66 inches is yellowish brown, mottled, firm, calcareous loam.

Included with this soil in mapping are small areas of soils that have dense gray clay at a depth of 20 to 36 inches. Also included are small areas of somewhat poorly drained Floyd soils along the waterways. The included soils make up less than 8 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 to 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction ranges from medium acid or strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage on this soil are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short, convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about

60 inches is yellowish brown, mottled, firm, calcareous loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of 20 to 36 inches. Small areas of somewhat poorly drained Floyd soils are along the waterways. The included soils make up less than 6 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. The reaction is strongly acid in the upper part of the subsoil and slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage on this soil are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is dark brown and very dark grayish brown loam about 8 inches thick. It has been mixed with material from the upper part of the brown subsoil by plowing. The subsoil is about 31 inches thick. The upper part is brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous loam mottled with grayish brown.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of 20 to 36 inches. Small areas of somewhat poorly drained Floyd soils are along waterways. The included soils make up less than 6 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. Typically, the reaction is medium acid to neutral in the plow layer, depending on past liming practices. The reaction ranges from medium acid or strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue to the surface or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage on this soil are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

83D2—Kenyon loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes, mainly adjacent to small streams and waterways. In places, however, it is adjacent to and parallel to flood plains. Individual areas are generally elongated in shape and range from 2 to 10 acres.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. It has been mixed with material from the upper part of the brown subsoil by plowing. The subsoil is about 28 inches thick. The upper part is brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 66 inches is yellowish brown, mottled loam.

Included with this soil in mapping are small areas that have dense, gray clay below a depth of 20 to 36 inches. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. The reaction ranges from medium acid or strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

84—Clyde silty clay loam, 0 to 3 percent slopes. This nearly level, poorly drained soil is in drainageways on uplands, on lower concave slopes, and at the head of drainageways. Individual areas range from 2 to 60 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam and very dark gray, mottled clay loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, mottled, friable clay loam; the middle part is light olive brown, mottled, friable loam; and the lower part is yellowish brown, mottled, very friable sandy loam. The substratum to a depth of about 72 inches is distinctly mottled. The upper part is yellowish brown sandy clay loam stratified with gray loam; the middle part is pale brown loamy sand; and the lower part is strong brown loam.

Included with this soil in mapping are a few small areas of Houghton and Palms soils, mainly near waterways and in more sloping parts. These organic soils are wetter than Clyde soils and are more difficult to tile drain. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. Content of organic matter in the surface layer is about 8 to 10 percent. The reaction is neutral, and this soil seldom if ever needs liming. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants (fig. 12). Tile drains work well if good outlets are available. Not tilling when the soil is wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet causes surface compaction and poor tilth.

This soil is in capability subclass IIw.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches. It is subject to flooding. Individual areas are irregular in shape and range from 5 to 25 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 15 inches thick. The subsoil is 21 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the middle part is dark grayish brown, friable, mottled silty clay loam; and the lower part is grayish brown and yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 74 inches is brownish yellow and light brownish gray, mottled silt loam underlain by light olive gray, mottled silty clay loam.

Included with this soil in mapping are small areas of poorly drained Bremer soils that are slightly lower on the landscape than this Nevin soil and are generally along waterways. The included soils make up less than 6 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 or 6 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The subsoil is slightly acid or medium acid and is medium in available phosphorus and very low in available potassium. This soil has good tilth.

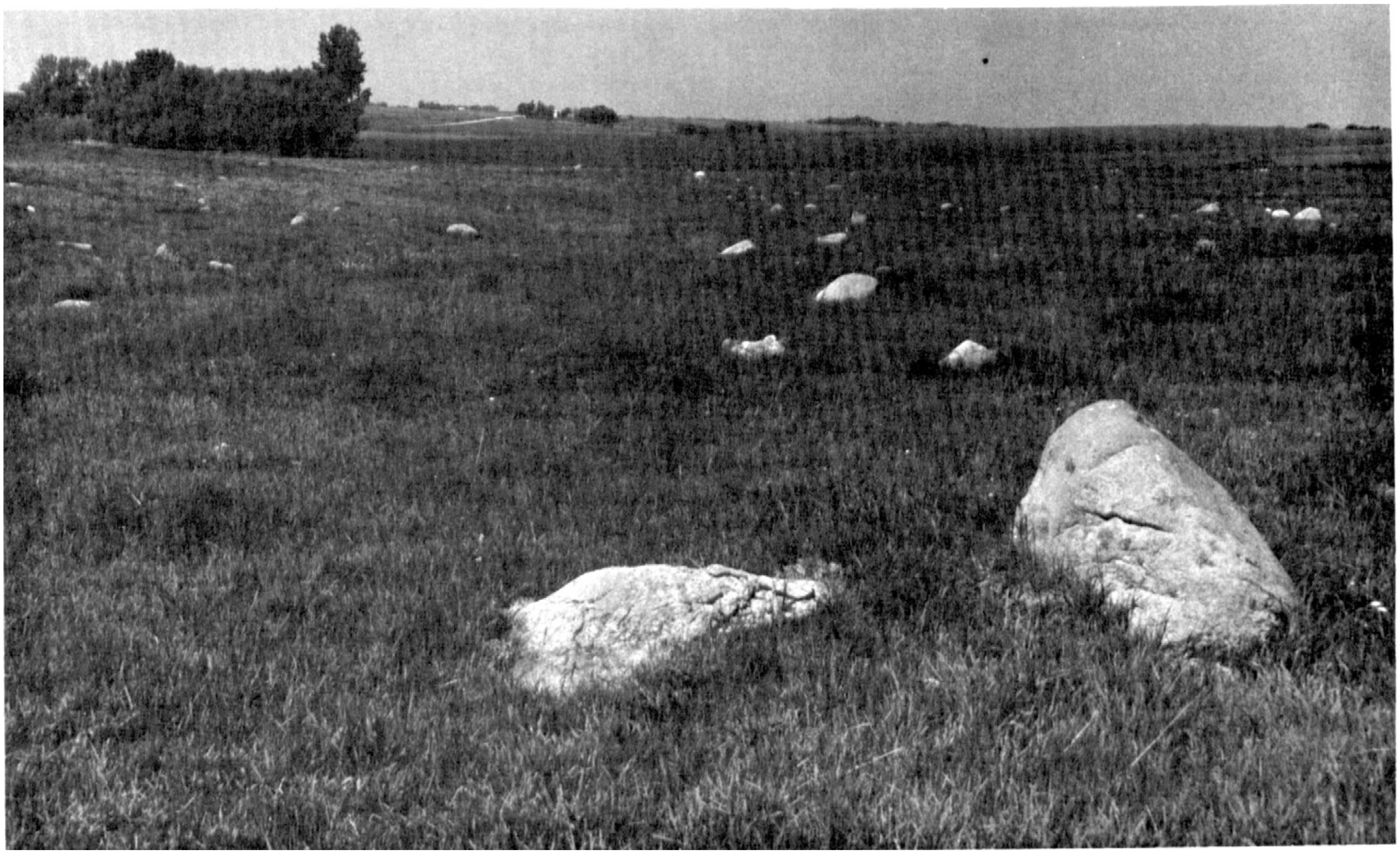


Figure 12.—Boulders in an area of undrained Clyde soils. In most areas the boulders have been picked up, the soil has been drained, and the areas are used for farming.

Most areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The only limitation of this soil is wetness during parts of the year, especially spring, and rare flooding. Timeliness of field operations may be improved by tile drainage. Diversion terraces placed on adjacent upland slopes protect areas of this soil from runoff and siltation.

If this soil is used as pastureland, overgrazing or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

109C—Backbone fine sandy loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, somewhat excessively drained soil is on ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 10 acres.

Typically, the surface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is about 27 inches thick. The upper part is brown, very friable sandy loam; the middle part is dark yellowish brown, very friable sandy loam and yellowish brown, friable sandy clay loam; and the lower part is brownish yellow, firm clay. Below this is hard, level bedded, limestone bedrock.

Included with this soil in mapping are small eroded spots in which the upper part of the brown subsoil has been mixed with the surface layer. Also included are a few small areas of Sogn soils that are steeper than this Backbone soil and are shallower to hard, bedded limestone. The included soils make up less than 5 percent of mapped areas.

This soil has low available water capacity and moderately rapid permeability. The runoff is medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction is slightly acid or neutral in the surface layer, depending on past liming practices.

The available phosphorus is low in the subsoil, and the available potassium is very low. This soil has good tilth.

Most areas of this soil are wooded. A few areas are used for cultivated crops. This soil is droughty. It is poorly suited to corn and soybeans and has fair suitability for hay and pasture. Crop production is very dependent on the amount and timeliness of rainfall. Soil blowing and water erosion are hazards to cultivated crops. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. If terracing this soil, the cuts should be held to a minimum to avoid exposing the bedrock. In places, the bedrock interferes with terrace construction.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is moderately suited to trees. A few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

110B—Lamont fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained and somewhat excessively drained soil is on upland ridges and side slopes and on stream benches. Individual areas are irregular in shape and range from 5 to 15 acres.

Typically, the surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 5 inches thick. The subsoil is about 28 inches thick. The upper part is very brown, friable fine sandy loam; the middle part is dark yellowish brown, very friable fine sandy loam; and the lower part is brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown loamy sand.

This soil has moderate available water capacity. Permeability is moderately rapid. Surface runoff is medium. Content of organic matter in the surface layer is about 0.5 to 1 percent. The reaction in the surface layer ranges from medium acid to neutral, depending on past liming practices. Reaction in the subsoil is medium acid or strongly acid. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. A few areas are wooded or in pastureland. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty during periods in most years. Soil blowing and water erosion are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic matter helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation or by spraying, cutting, and girdling. There are no hazards or limitations when planting or harvesting trees.

This soil is in capability subclass IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained and somewhat excessively drained soil is on upland ridges and side slopes and on stream benches. Individual areas are irregular in shape and range from 5 to 15 acres.

Typically, the surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable fine sandy loam; the middle part is dark yellowish brown, very friable fine sandy loam; and the lower part is brown, very friable loamy sand. The substratum is brown loamy sand.

This soil has moderate available water capacity. Permeability is moderately rapid. Surface runoff is medium. Content of organic matter in the surface layer is about 0.5 to 1 percent. The reaction in the surface layer ranges from medium acid to neutral, depending on past liming practices. Reaction in the subsoil is medium acid or strongly acid. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. A few areas are in pastureland or are wooded. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Crop production depends on the amount and timeliness of rainfall. Soil blowing and water erosion are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In places, farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of poor stability in this

soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

118—Garwin silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on long, broad, slightly concave to very slightly convex slopes on uplands and at the heads of drainageways. Individual areas are irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray clay loam about 14 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, mottled, friable silty clay loam; the middle part is olive gray, mottled, friable silty clay loam; and the lower part is olive gray and light olive brown, mottled, friable silty clay loam. The substratum to a depth of about 72 inches is dark grayish brown and dark yellowish brown, mottled sandy loam that is underlain by yellowish brown and strong brown, mottled, calcareous loam.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow, and ponding can occur in low places for short periods. Content of organic matter in the surface layer is about 6 or 7 percent. The reaction is slightly acid or neutral in the surface layer. The reaction is neutral in the subsoil and is neutral or mildly alkaline in the substratum. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and are used for cultivated crops. This soil is suited to soybeans, corn, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available. Not tilling the soil when it is wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

119—Muscatine silty clay loam, 1 to 3 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on slightly concave side slopes on uplands. Individual areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark brown silty clay loam about 13 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, friable silty clay loam; the middle part is olive brown, friable silty clay loam; and the lower part is light olive brown, mottled, friable silty clay loam. The substratum to a depth of about 72 inches is yellowish brown, mottled sandy loam that is underlain by yellowish brown and strong brown loam mottled with gray.

Included with this soil in mapping are small areas of poorly drained Garwin soils in drainageways. The included soils make up less than 5 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 or 6 percent. The reaction is neutral or slightly acid in the surface layer, depending on past liming practices. The subsoil is neutral or slightly acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The only limitation of this soil is wetness during some parts of the year, especially in spring. Timeliness of field operations may be improved by tile drainage. The more sloping areas of this soil are subject to slight erosion when cropped. Conservation tillage, which leaves crop residue on the surface, reduces the hazard of erosion.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

120—Tama silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on uplands. Individual areas are irregular in shape and range from 4 to 50 acres.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown silt loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 80 inches is a thin lens

of yellowish brown sandy loam overlying yellowish brown, friable silt loam.

This soil has very high available water capacity and is moderately permeable. The surface runoff is slow. Content of organic matter in the plow layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the plow layer, depending on past liming practices. The reaction in the subsoil is slightly acid or medium acid. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Nearly all areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

120B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 4 to 50 acres.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 43 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 80 inches is a thin lens of yellowish brown sandy loam overlying yellowish brown silt loam.

This soil has very high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the plow layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil is medium acid or slightly acid. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Nearly all areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom lands. It is subject to flooding. Individual areas are irregular in shape and range from 3 to 60 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 43 inches thick. It is mottled in the lower part. The mottled substratum to a depth of about 72 inches is olive gray, mottled, friable silty clay loam and light olive gray, friable silt loam.

This soil has very high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction is neutral or slightly acid. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. A few areas are in pastureland. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if outlets are available. Not tilling when the soil is too wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

135—Coland clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom lands. It is subject to flooding. Individual areas are irregular in shape and range from 3 to 60 acres or more.

Typically, the surface layer is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 34 inches thick. The substratum to a depth of about 66 inches is stratified very dark gray, mottled sandy clay loam and sandy loam.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction is neutral or slightly acid. This soil has good tilth.

Most areas of this soil are used for cultivated crops. A few areas are in pastureland. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets

are available. Not tilling when the soil is too wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

150B—Hanska loam, 1 to 4 percent slopes. This nearly level and gently sloping, poorly drained soil is on uplands. The slopes are short and range from concave to slightly convex. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black loam about 5 inches thick. The subsoil is gray, friable loam and fine sandy loam about 20 inches thick. The substratum to a depth of about 61 inches is gray loamy fine sand and yellowish brown loamy coarse sand. In places, loam glacial till is below a depth of 45 to 60 inches. In some areas, the surface layer is mucky loam or mucky sandy loam.

This soil has moderate available water capacity. It has a seasonal high water table. Permeability is moderately rapid in the subsoil and rapid in the substratum. Surface runoff is slow, and this soil receives some runoff. Content of organic matter in the plow layer is about 7 to 9 percent. The reaction is neutral or slightly acid in the surface layer and subsoil. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Areas of this soil are drained by tile and are used for cultivated crops. Many areas, however, are not drained and are not cultivated. Where properly tile drained, this soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Tile placement and stability are difficult in most places because of loose, water-bearing sands. Returning crop residue or regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil mainly is on stream benches but in some areas is in drainageways on uplands. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is black, friable clay loam about 8 inches thick. The subsurface layer is black clay loam about 7 inches thick. The subsoil is about 13 inches thick. The upper part is very dark gray and grayish brown, mottled, friable clay loam; and the lower part is olive gray and grayish brown, mottled, very friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled loamy sand underlain by coarse multicolored sand. In places, sand and gravel is at a depth of 18 to 24 inches. In a few places, the surface layer is calcareous.

This soil has low available water capacity. It has a seasonal high water table. Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 6 or 7 percent. The reaction is neutral or slightly acid in the surface layer and subsoil. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and used for cultivated crops. This soil is suited to corn, soybeans, and small grains where properly drained and is suited to grasses and legumes for hay and pasture. Tile placement and stability are difficult in places because of loose, water-bearing sands. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is mainly on stream benches, but in some areas it is in drainageways on uplands. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is very dark gray, friable clay loam; the middle part is grayish brown and olive gray, mottled, friable clay loam; and the lower part is grayish brown, very friable, mottled sandy loam. The substratum to a depth of about 60 inches is light brownish gray, mottled loamy sand in the upper part and multicolored coarse sand in the lower part. In places, sand and gravel is at a depth of 40 to 60 inches. In a few places, the surface layer is calcareous.

This soil has moderate available water capacity. It has a seasonal high water table. Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 6 or 7 percent. The reaction is neutral or slightly acid in the surface layer and subsoil. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and used for cultivated crops. This soil is suited to corn, soybeans, and small grains where properly drained and is suited to grasses and legumes for hay and pasture. Tile placement and stability are difficult in places because of loose, water-bearing sands. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

153—Shandep clay loam, 0 to 1 percent slopes. This level, very poorly drained soil is in slight depressions on stream benches. It is subject to flooding. Individual areas are irregular in shape and range from 2 to 60 acres.

Typically, the surface layer is black clay loam about 19 inches thick. The subsurface layer is black and very dark gray clay loam about 17 inches thick. The subsoil is about 12 inches thick. It is dark gray, mottled, friable sandy clay loam in the upper part and dark gray, mottled sandy loam in the lower part. The substratum to a depth of about 60 inches is gray medium and coarse sand containing a few pebbles. In places, sand or gravel is at a depth of 24 inches. The substratum is calcareous in some areas.

This soil has high available water capacity. It has a seasonal high water table. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is very slow, or the water is ponded. Content of organic matter in the surface layer is about 7 to 10 percent. The reaction is neutral or slightly acid in the surface layer and is neutral or mildly alkaline in the subsoil. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil do not have artificial drainage. These areas have water within a few inches of the surface during most years. They are poorly suited to pasture and are not suited to cultivated crops, hay, or trees. Where properly drained, this soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

162C—Downs silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 64 inches is dark yellowish brown, friable silt loam.

Included with this soil in mapping are eroded areas of soil in which dark yellowish brown, silty clay loam, subsoil material has been mixed into the surface layer. The included soils make up less than 5 percent of the mapped areas.

This soil has very high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 to 3 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The reaction is medium acid or strongly acid in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for woodland or grassland. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is brown silt loam about 8 inches thick. It has been mixed with the upper part of the

dark yellowish brown silt loam subsoil by plowing. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is dark yellowish brown silt loam. In places, the subsoil is silt loam throughout.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the plow layer is about 1 to 2 percent. The reaction ranges from neutral to medium acid in the plow layer, depending on past liming practices. The reaction is medium acid or strongly acid in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops (fig. 13). This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil for pasture or hayland helps control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

171—Bassett loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on uplands on high, broad ridge crests and on low, benchlike

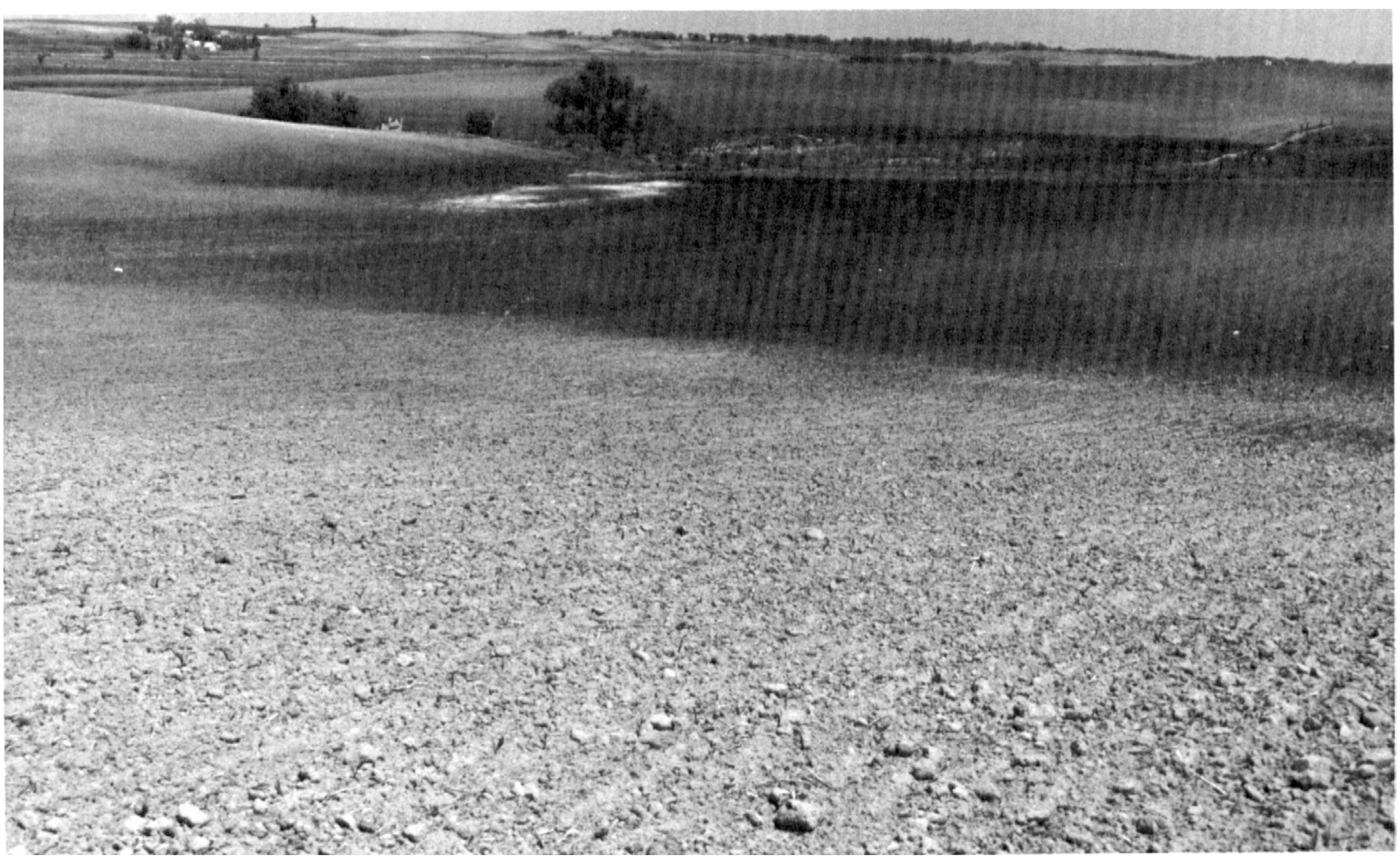


Figure 13.—Well drained, eroded Downs soils are in the foreground and on side slopes. The dark colored areas near the drainageways are the somewhat poorly drained Ely soils and poorly drained Colo soils.

positions. In many of the lower lying positions, limestone bedrock is below a depth of 5 to 12 feet. Individual areas are irregular in shape and range from 3 to about 30 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm clay loam and yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam.

Included with this soil in mapping are small areas of well drained Wapsie and Winneshiek soils on landscape positions similar to those of the Bassett soil. Wapsie soils have a sandy substratum, and Winneshiek soils are underlain by limestone bedrock. The included soils make up about 2 to 4 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability class I.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 37 inches thick. The upper part is brown, firm clay loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown firm, mottled loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. Small areas of somewhat poorly drained Floyd and Schley soils are along waterways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage on this soil are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side

slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The surface layer has been mixed with brown loam from the upper part of the subsoil. The subsoil is about 31 inches thick. The upper part is brown and yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. Small areas of somewhat poorly drained Floyd and Schley soils are along the waterways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from medium acid to neutral in the plow layer, depending on past liming practices. The reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or regular addition of organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage on this soil are difficult, because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes on uplands. It is mainly adjacent to small streams and waterways but in places is adjacent to and parallel to the flood plains. Individual areas are generally elongated and range from 2 to 10 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. It has been mixed with brown loam from the upper part of the subsoil. The subsoil is about 30 inches thick. The upper part is brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and gray, mottled, firm, calcareous loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or regular addition of organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage are major limitations on this soil. They are difficult to overcome because practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and the unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and

restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

171F—Bassett loam, 14 to 25 percent slopes. This moderately steep and steep, moderately well drained soil is on short, convex side slopes on uplands. It is mainly adjacent to and parallel to flood plains and the small streams and waterways that drain onto the flood plains. Typically, individual areas are elongated, and some extend for 3/4 mile or more along the flood plains. Areas range from 2 to 50 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and gray, mottled, calcareous loam.

Included with this soil in mapping are areas of soils that are slowly permeable and have a clay loam subsoil and substratum. Also included are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is rapid. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction is slightly acid or medium acid in the surface layer. It ranges from medium acid to very strongly acid in the subsurface layer and upper part of the subsoil to slightly acid or medium acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Nearly all areas of this soil are wooded or are in grassland. This soil is better suited to trees and to grasses and legumes for hay and pasture than to most other uses. It is not suited to cultivated crops because of the erosion hazard and the danger of operating farm machinery on steep slopes.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poor tilth and moderate to severe erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is moderately suited to trees, and small areas remain in native hardwoods. Careful consideration should be given to the location of trails or logging roads to reduce the possibility of erosion. Laying out the trails or roads on the contour, or nearly on the contour, helps to reduce erosion. The steepness of this soil is a hazard to the operation of equipment. Special equipment can be used if caution is exercised in the operation. The survival of seedlings or competition from undesirable plants is not expected to be a problem.

This soil is in capability subclass VIe.

173—Hoopeston fine sandy loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and uplands. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is black fine sandy loam about 10 inches thick. The subsurface layer is very dark brown fine sandy loam about 10 inches thick. The subsoil is dark grayish brown, mottled, very friable fine sandy loam about 9 inches thick. The substratum to a depth of about 72 inches is brown and light brownish gray, mottled sand.

Included with this soil in mapping are small areas of poorly drained Marshan soils along drainageways. The included soils make up about 2 to 5 percent of the mapped areas.

This soil has low available water capacity. It has a seasonal high water table. Permeability is moderately rapid in the subsoil and rapid in the substratum. Runoff is slow, and some runoff is received from adjacent soils. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction in the surface layer ranges from medium acid to neutral, depending on past liming practices. The lower part of the surface layer and the subsoil range from slightly acid to strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in some years. It is susceptible to soil blowing if cultivated. Tile placement and stability are difficult in places because of loose, water-bearing sands. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility. Cultivation after heavy rains helps to prevent damage to small row crops from blowing sand.

The use of this soil as pasture or hayland helps to control soil blowing. Overgrazing, however, causes some surface compaction, increases runoff, results in poorer tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

173B—Hoopeston fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained

soil is on concave foot slopes on uplands adjacent to drainageways. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is black fine sandy loam about 8 inches thick. The subsurface layer is very dark brown fine sandy loam about 8 inches thick. The subsoil is dark grayish brown, mottled, very friable fine sandy loam about 14 inches thick. The substratum to a depth of about 72 inches is grayish brown, mottled loamy fine sand and light brownish gray, mottled sand. In places, the surface and subsurface layers are black loam.

Included with this soil in mapping are a few small areas of well drained to somewhat excessively drained Dickinson soils that are slightly more sloping than the Hoopeston soil. Small areas of poorly drained Hanska soils are near the heads of some drainageways. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. It has a seasonal high water table. Permeability is moderately rapid in the subsoil and rapid in the substratum. Runoff is slow, and some runoff is received from the adjacent soils. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction in the surface layer ranges from medium acid to neutral, depending on past liming practices. The lower part of the surface layer and the subsoil ranges from slightly acid to strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in some years. If it is cultivated, it is susceptible to soil blowing and water erosion. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and reduce erosion. Terraces can be difficult to construct because of poor stability in this soil. Cultivation after heavy rains helps to prevent damage to small row crops from blowing sand.

The major limitation of this soil is wetness, especially in spring and during rainy seasons. Wetness is due in part to seepage on side slopes. A drainage system that intercepts lateral moving water is the most successful. Tile placement and stability are difficult in most places because of loose, water-bearing sands.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing, however, causes some surface compaction, increases runoff, results in poorer tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

174—Bolan loam, 0 to 2 percent slopes. This nearly level, well drained soil is on very low mounds or dunelike uplands and on stream benches. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown and yellowish brown, very friable loam; and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum to a depth of about 80 inches is yellowish brown loamy fine sand.

Included with this soil in mapping are small areas of well drained, silty Waukegan soils and well drained, loamy Saude and Waukee soils. These soils are on stream benches and in positions similar to those of the Bolan soil. The Saude and Waukee soils have a coarser textured substratum. The included soils make up less than 10 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Content of organic matter in the surface layer is 2 or 3 percent. The reaction in the surface layer is neutral or slightly acid, depending on past liming practices. The subsoil is slightly acid or medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of below average rainfall. Returning crop residue or regular addition of other organic materials helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on uplands on convex ridge crests and side slopes and on stream benches. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown and yellowish brown, very friable loam; and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum to a depth of about 80 inches is yellowish brown loamy fine sand.

Included with this soil in mapping are small areas of well drained and somewhat excessively drained Dickinson soils and well drained Saude and Waukee soils. These soils are on landscape positions similar to

those of this Bolan soil. The Saude and Waukee soils have a coarser textured substratum. The included soils make up less than 5 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Content of organic matter in the surface layer is 2 or 3 percent. The reaction in the surface layer is neutral or slightly acid, depending on past liming practices. The subsoil is slightly acid or medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic materials helps to improve fertility and maintain good tilth. When terracing this soil, the cuts should be held to a minimum to avoid exposing the loamy sand and sand.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is in capability subclass IIe.

174C2—Bolan loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on uplands on convex ridge crests and side slopes and on stream benches. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. It has been mixed with the brown loam from the upper part of the subsoil. The subsoil is about 20 inches thick. The upper part is dark yellowish brown and yellowish brown loam; and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum to a depth of about 80 inches is yellowish brown loamy fine sand and sand.

Included with this soil in mapping are small areas of well drained and somewhat excessively drained Dickinson soils and excessively drained Sparta soils. These soils are in landscape positions similar to those of this Bolan soil. The included soils make up less than 5 percent of mapped areas.

This soil has moderate or moderately low available water capacity. Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Content of organic matter in the surface layer is 1 or 2 percent. The reaction in the surface layer is neutral or slightly acid, depending on past liming practices. The subsoil is medium acid or slightly acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the cuts should be held to a minimum to avoid exposing the loamy sand and sand.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is in capability subclass IIIe.

175—Dickinson fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained and somewhat excessively drained soil is on slightly convex areas on stream benches and uplands. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is very dark brown fine sandy loam about 8 inches thick. The subsurface layer is very dark brown fine sandy loam about 9 inches thick. The subsoil is dark yellowish brown, very friable fine sandy loam about 14 inches thick. The substratum to a depth of about 72 inches is dark yellowish brown and brown loamy sand.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hoopeston soils at a slightly lower elevation than this Dickinson soil. The included soils make up less than 5 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderately rapid in the subsoil and rapid in the substratum. Runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction in the surface layer is slightly acid or neutral, depending on past liming practices. The subsoil is slightly acid or medium acid and is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in most years. It is susceptible to soil blowing if cultivated. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve

fertility. Cultivation after heavy rains helps to prevent damage to small row crops from blowing sand.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing, however, causes surface compaction, results in poorer tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained and somewhat excessively drained soil is on convex mounds and dunes on stream benches and uplands. Individual areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is very dark brown fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is dark yellowish brown, very friable fine sandy loam about 9 inches thick. The substratum to a depth of about 72 inches is dark yellowish brown and brown loamy sand.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hoopeston soils near drainageways. The Hoopeston soils are less sloping than this Dickinson soil. The included soils make up less than 5 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderately rapid in the subsoil and rapid in the substratum. Runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction in the surface layer is neutral or slightly acid, depending on past liming practices. The subsoil is slightly acid or medium acid and is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in most years. Water erosion and soil blowing are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and reduce erosion. Terraces may be difficult to construct because of poor stability in this soil. Cultivation after heavy rains helps to prevent damage to small row crops from blowing sand.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing, however, causes some surface compaction, increases runoff, results in poorer tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained and somewhat excessively drained soil is on convex mounds and dunes on stream benches and uplands. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark brown fine sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is dark yellowish brown, very friable fine sandy loam about 9 inches thick. The substratum to a depth of about 72 inches is dark yellowish brown and brown loamy sand.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hoopeston soils that are less sloping than this Dickinson soil and are near drainageways. The included soils make up less than 5 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderately rapid in the subsoil and rapid in the substratum. Runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction in the surface layer is neutral or slightly acid, depending on past liming practices. The subsoil is slightly acid or medium acid and is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty, however, and crop production depends on the amount and timeliness of rainfall. Soil blowing and water erosion are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and winter cover crops help to prevent excessive soil loss. In some areas, contour farming can be beneficial. Terraces are difficult to construct and maintain because of poor stability in this soil. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation and prescribed burning or by spraying, cutting, and girdling.

This soil is in capability subclass IIIe.

177—Saude loam, 0 to 2 percent slopes. This nearly level, well drained soil mainly is on stream benches, but it is on uplands in some areas. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark

grayish brown loam about 4 inches thick. The subsoil is about 19 inches thick. The upper part is brown and dark yellowish brown, friable loam; and the lower part is yellowish brown, loose loamy sand. The substratum to a depth of about 60 inches is yellowish brown and strong brown sand. On uplands in places, the subsoil contains slightly higher content of clay, and the subsoil and substratum have a slightly reddish cast.

Included with this soil in mapping are small areas of somewhat poorly drained Lawler soils and somewhat excessively drained Flagler soils. The Flagler soils are in landscape positions similar to those of this Saude soil, and the Lawler soils are on lower positions and near the waterways. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

177B—Saude loam, 2 to 5 percent slopes. This gently sloping, well drained soil mainly is on stream benches but is on uplands in some areas. Individual areas are irregular in shape and range from 2 to about 50 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 16 inches thick. The upper part is dark yellowish brown, friable loam; and the lower part is yellowish brown, loose, loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand. On uplands in places, the subsoil and substratum have a slightly reddish cast, and the subsoil contains slightly higher content of clay.

Included with this soil in mapping are small areas of well drained Bolan soils and somewhat excessively drained Flagler soils on landscape positions similar to those of this Saude soil. The Bolan soils do not have a coarse textured substratum. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid. It is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the cuts should be held to a minimum to avoid exposing the sandy and gravelly material.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is in capability subclass IIe.

177C—Saude loam, 5 to 9 percent slopes. This moderately sloping, well drained soil mainly is on stream benches but is on uplands in some areas. Individual areas are elongated and range from 2 to about 10 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 3 inches thick. The subsoil is about 13 inches thick. The upper part is dark yellowish brown, friable loam; and the lower part is yellowish brown, loose, loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand. On uplands in places, the subsoil and substratum have a slightly reddish cast, and the subsoil contains slightly higher content of clay.

Included with this soil in mapping are small areas of excessively drained Burkhardt soils and somewhat excessively drained Flagler soils. These soils are on landscape positions similar to those of this Saude soil. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The

reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or strongly acid. It is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, cuts should be held to a minimum to avoid exposing the sandy and gravelly material.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is in capability subclass IIIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil mainly is on stream benches but is on uplands in some areas. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, friable loam; the middle part is brown loam; and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown loamy coarse sand.

Included with this soil in mapping are small areas of Terril loam along waterways and adjacent to areas of more sloping soils. Terril soils have thicker, darker colored surface and subsurface layers than this Waukee soil. They make up less than 5 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of below average rainfall. Returning crop residue or the regular addition of other organic materials helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class IIs.

178B—Waukee loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex slopes. It mainly is on stream benches but is on uplands in some areas. Individual areas are irregular in shape and range from 3 to 20 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, loamy coarse sand.

Included with this soil in mapping are small areas of more sloping Ostrander soils on uplands and of Terril loam along waterways and adjacent to the more sloping soils. The Terril soils have thicker, darker colored surface and subsurface layers than this Waukee soil. The included soils make up less than 6 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is medium. Content of organic matter in the surface layer is 3 or 4 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of below average rainfall. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the cuts should be held to a minimum to avoid exposing the sandy and gravelly material.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing and

restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

184—Klinger silty clay loam, 1 to 3 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, mottled, friable silty clay loam; the middle part is dark grayish brown, friable silty clay loam; and the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Included with this soil in mapping are small areas of poorly drained Maxfield soils in drainageways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 or 6 percent. The reaction is neutral to medium acid in the surface layer, depending on past liming practices. The reaction is slightly acid or medium acid in the silty part of the subsoil and is slightly acid or neutral in the glacial till part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The only limitation of this soil is wetness during some parts of the year, especially in spring. Timeliness of field operations may be improved by tile drainage. Erosion is a slight hazard to more sloping areas if this soil is used for cropland.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

198B—Floyd loam, 1 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on concave, upland foot slopes adjacent to drainageways. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 15 inches thick. The subsoil is about 32 inches thick. The upper part is olive brown, mottled, friable loam; the middle part is light olive brown, mottled, very friable sandy loam; and the lower part is yellowish brown and grayish brown, mottled, firm loam. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, mottled loam.

Included with this soil in mapping are small areas of poorly drained Clyde soils in drainageways. The included soils make up less than 10 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is slow, and this soil receives runoff from adjacent higher lying soils. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction is slightly acid or neutral in the surface layer, depending on past liming practices. The subsoil is slightly acid or neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. If this soil is drained by tile, it is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic matter helps to improve fertility and maintain good tilth.

The major limitation of this soil is wetness, especially in spring and during rainy periods. Erosion is a slight hazard in some areas used for cropland. Wetness is due in part to seepage on side slopes. A drainage system that intercepts lateral moving water is the most successful.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increase runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

201B—Coland-Terril complex, 1 to 4 percent slopes. This complex consists of nearly level and gently sloping, poorly drained and moderately well drained soils on narrow flood plains and on foot slopes on uplands. Individual areas are generally long and narrow and range from 3 to 30 acres. About 50 to 60 percent of this complex is Coland soils and 30 to 40 percent is Terril soils. Coland soils are along the drainageways, and Terril soils are on the foot slopes. The Coland soils are subject to flooding.

Typically, the surface layer of the Coland soil is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 34 inches thick. The substratum to a depth of about 66 inches is stratified, very dark gray, mottled sandy clay loam and sandy loam.

Typically, the surface layer of the Terril soil is very dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 24 inches thick. The subsoil to a depth of about 60 inches is dark brown, friable clay loam in the upper part and dark yellowish brown, friable loam in the lower part.

The soils in this complex have high available water capacity and are moderately permeable. Runoff is medium, and these soils receive runoff and seepage from adjacent slopes. Content of organic matter in the surface layer of the Coland soil is 5 to 7 percent and in the Terril soil is about 4 or 5 percent. These soils have good tilth.

Most areas of these soils are in pastureland. If the areas are drained by tile, this complex is suited to corn, soybeans, and small grains and to grasses and legumes for hay. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available.

If this complex is used for cultivated crops, gully erosion is a hazard. Conservation tillage, which leaves crop residue on the surface, and grassed waterways help prevent gullies. Interceptor tile helps to remove the excess seepage from adjacent slopes. Where runoff concentrates, areas are subject to gully erosion. Diversion terraces are needed in these areas to intercept runoff. Not tilling when the soils are wet and returning crop residue help to maintain good tilth. Overgrazing pasture or grazing when the soils are too wet causes surface compaction and poor tilth.

This complex is in capability subclass IIw.

213—Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on broad upland ridges and on stream benches. Individual areas are irregular in shape and range from 2 to 100 acres, but most are about 4 to 20 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is dark brown, friable loam; the middle part is dark yellowish brown, friable sandy clay loam and yellowish brown, friable clay loam; and the lower part is brown, very firm silty clay. The subsoil is underlain by hard, level bedded, shattered limestone bedrock. In places, limestone is at a depth of 40 to 60 inches.

This soil has moderate available water capacity and is moderately permeable. The surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of below average rainfall. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridge crests and side slopes on uplands and on stream benches. Individual areas are irregular in shape and range from 2 to 60 acres but are generally about 4 to 8 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is dark brown, friable loam; the middle part is dark yellowish brown, friable sandy clay loam and yellowish brown, firm clay loam; the lower part is brown, very firm silty clay. Below this is hard, level bedded, shattered limestone bedrock. in places, limestone is at a depth of 40 to 60 inches.

This soil has moderate available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 to 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of below average rainfall. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Terrace construction is difficult in spots because of the shallowness to limestone bedrock. When terracing this soil, cuts should be held to a minimum to avoid exposing the bedrock.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of

grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridge crests and side slopes on uplands and on stream benches. Individual areas are irregular in shape and range from 2 to 60 acres but are generally about 4 to 8 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, firm clay loam; and the lower part is brown, very firm silty clay. Below this is hard, level bedded, shattered, limestone bedrock. In places, the depth to limestone is less than 20 inches. A few areas have outcrops of limestone.

This soil has low available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. In most places, bedrock interferes with the construction of terraces, or terrace construction is difficult because of the shallowness to bedrock. When terracing this soil, cuts should be held to a minimum to avoid exposing the bedrock.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

214C—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridge crests and side slopes on uplands. In some areas, it is above the steep Sogn soils. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 4 inches thick. The subsoil is about 14 inches thick. The upper part is brown, firm clay loam; and the lower part is brown, very firm silty clay. Below this is hard, level bedded, shattered, limestone bedrock. In places, the depth to limestone is less than 20 inches. A few areas have outcrops of limestone. In places in eroded areas, material from the brown subsoil is mixed with the surface layer.

This soil has low available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Many areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. In most places, bedrock interferes with the construction of terraces, or terrace construction is difficult because of the shallowness to bedrock. When terracing this soil, cuts should be held to a minimum to avoid exposing the bedrock.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

214C2—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. It has been mixed with brown clay loam from the upper part of the subsoil by plowing. The subsoil is about 14 inches thick. The upper part is brown, firm clay loam; and the lower part is brown, very firm silty clay. Below this is hard, level bedded, shattered, limestone bedrock. In places, the depth to limestone is less than 15 inches, and a few areas have outcrops of limestone.

This soil has low available water capacity and is moderately permeable. The surface runoff is slow. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops or have been used for cropland at one time. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. In most areas, terrace construction is difficult because of the shallowness to bedrock. When terracing this soil, cuts should be held to a minimum to avoid exposing the bedrock.

The use of this soil for pasture or hayland helps to control further erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

221B—Palms muck, 2 to 5 percent slopes. This gently sloping, very poorly drained soil is on lower parts of side slopes on uplands and on stream benches. It is subject to ponding of water. Individual areas are generally long and narrow and range from 2 to 20 acres.

Typically, the surface layer is black sapric material about 8 inches thick. The subsurface layer is black sapric material about 22 inches thick. The substratum to a depth of about 60 inches is gray and very dark gray, mottled clay loam.

Included with this soil in mapping are areas of Houghton soils that have an organic layer more than 51 inches thick. Tile lines settle and are difficult to maintain in the Houghton soils. The included soils make up less than 10 percent of the mapped areas.

This soil has very high available water capacity. It has a seasonal high water table. Permeability is moderately slow to moderately rapid in the surface soil and moderate to moderately slow in the substratum. Content of organic matter in the surface soil is about 25 to 40 percent. This soil is neutral or slightly acid and seldom or never needs liming. The surface soil is very low in available phosphorus and potassium. Undrained areas are hummocky unless they have been leveled. This soil has good tilth.

Most areas of this soil are in pastureland or are idle. Where tile drained, this soil is suited to corn and **soybeans and to grasses for hay and pasture. Lodging of small grains is a problem on this soil. Undrained areas** are poorly suited to pasture, however, this soil is difficult to drain adequately (fig. 14). Interceptor tile is needed to drain seepage. In many places, adjoining soils on higher positions have a sand and gravel substratum.

This soil is in capability subclass IIIw.

225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to 60 acres or more.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 13 inches thick. The upper part is very dark grayish brown, friable loam; and the lower part is gray and yellowish brown, mottled, friable loam. The substratum to a depth of about 64 inches is brown, mottled loamy coarse sand and very coarse sand.

Included with this soil in mapping are small areas of Marshan soils along waterways. Marshan soils are wetter and have more clay in the subsoil than this Lawler soil. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. It has a seasonal high water table. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 4 or 5 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or slightly acid and is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of below average rainfall. Returning crop residue or the regular addition of other organic materials helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to 60 acres or more.

Typically, the surface layer is black loam about 8

Figure14.—Palms muck on a hillside seep. These soils are very difficult to drain and farm successfully.

inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part is very dark grayish brown, friable clay loam; the middle part is dark grayish brown loam; and the lower part is gray and yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is loamy coarse sand and very coarse sand containing some gravel. In a few places, the surface layer is very dark grayish brown loam about 8 inches thick, and the subsoil is more acid.

Included with this soil in mapping are small areas of Marshan soils along waterways. The Marshan soils contain more clay than this Lawler soil and are wetter in the subsoil. The included soils make up less than 10 percent of mapped areas.

This soil has moderate available water capacity. It has a seasonal high water table. Permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 4 or 5 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is medium acid or slightly acid and is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of below average rainfall. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

241C2—Saude-Burkhardt complex, 2 to 9 percent slopes, moderately eroded. This complex consists of gently sloping and moderately sloping, well drained and excessively drained soils on side slopes and ridges on uplands. Individual areas are irregular in shape and range from 3 to 100 acres. This unit is about 50 percent Saude soils and 40 percent Burkhardt soils. Areas of these soils are so intricately mixed or so small that to separate them in mapping was not practical.

Typically, the surface layer of the Saude soil is dark brown and brown loam about 8 inches thick. It has been mixed with the dark yellowish brown loam upper part of the subsoil. The subsoil is about 13 inches thick. The upper part is dark yellowish brown, friable loam; and the lower part is yellowish brown, loose loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand and gravelly sand.

Typically, the surface layer of the excessively drained Burkhardt soil is dark brown sandy loam about 9 inches thick. The subsurface layer is dark brown sandy loam about 3 inches thick. The subsoil is brown, loose gravelly fine sandy loam about 5 inches thick. The substratum is brown and yellowish brown, stratified gravelly loamy sand and gravelly sand.

The Saude soil has low available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. Typically, reaction in the surface layer is neutral to medium acid, depending on past liming practices. Reaction in the subsoil is medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

The Burkhardt soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. The surface runoff is slow. Content of organic matter in the surface layer is about 0.5 or 1 percent. Typically, reaction in the surface layer is neutral to medium acid, depending on past liming practices. Reaction is slightly acid to strongly acid in the subsoil and substratum. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of these soils are used for cultivated crops or have been used for cropland. This complex has fair suitability for corn, soybeans, and small grains for hay and pasture. Soil blowing and water erosion are hazards in areas of cultivated cropland. Because of the low available water capacity, the plant population should be maintained at less density than on most other soils. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic materials helps to improve fertility and reduce erosion. When terracing areas of these soils, cuts can expose the sandy and gravelly material in places.

The use of these soils as pasture and hayland helps to control soil blowing and water erosion. Overgrazing pasture increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing during dry periods help to keep the pasture in good condition.

These soils are moderately suited to trees, but wooded areas are mostly limited to groves and trees around farmsteads. Survival of natural or planted seedlings is a concern. Because of this, seedlings should be spaced closely together when planting and should be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This complex is in capability subclass IVe.

241E2—Saude-Burkhardt complex, 9 to 18 percent slopes, moderately eroded. This complex consists of strongly sloping and moderately steep, well drained and excessively drained soils on side slopes and narrow ridges on uplands. Individual areas are irregular in shape and range from 3 to 70 acres. This complex is about 50 percent Saude soils and 40 percent Burkhardt soils. Areas of these soils are so intricately mixed or so small that to separate them in mapping was not practical.

Typically, the surface layer of the Saude soil is dark brown loam about 6 inches thick. It has been mixed with the upper part of the yellowish brown loam subsoil. The subsoil is about 10 inches thick. The upper part is dark yellowish brown, friable loam; and the lower part is yellowish brown, loose loamy sand. The substratum to a depth of about 60 inches is yellowish brown loamy sand and gravelly sand.

Typically, the surface layer of the excessively drained Burkhardt soil is dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown sandy loam about 3 inches thick. The subsoil is brown, loose fine gravelly sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown, stratified loamy sand and gravelly sand.

The Saude soil has low available water capacity. Permeability is moderate in the subsoil and very rapid in the substratum. The surface runoff is rapid. Content of organic matter in the surface layer is about 1 or 2 percent. Typically, reaction in the surface layer is neutral to medium acid, depending on past liming practices. Reaction in the subsoil is medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

The Burkhardt soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. The surface runoff is medium. Content of organic matter in the surface layer is about 0.5 or 1 percent. Typically, reaction in the surface layer is neutral to medium acid, depending on past liming practices. Reaction is slightly acid to strongly acid in the

subsoil and substratum. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of these soils are used for cultivated crops or have been used for cropland. This complex is not suited to cultivated crops, but it has fair suitability for small grains and for hay and pasture. Soil blowing and water erosion are hazards in areas used for cultivated cropland. Because of the low available water capacity, the plant population should be maintained at less density than on most other soils. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic materials helps to improve fertility and reduce erosion. When terracing, exposing the sandy and gravelly material in the cuts is possible.

The use of this complex as pasture and hayland helps to control soil blowing and water erosion. Overgrazing increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing during dry periods help to keep the pasture in good condition.

This complex is in capability subclass VIe.

284—Flagler sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on stream benches and on uplands. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown sandy loam about 7 inches thick. The subsoil is dark brown and brown, very friable sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, loose loamy sand. In places on uplands, the subsoil and substratum have a slightly reddish cast.

Included with this soil in mapping are small areas of somewhat poorly drained Hoopeston and Lawler soils at a slightly lower elevation. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is slightly acid to strongly acid. It is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in most years. Soil blowing is a hazard in areas of cultivated cropland. Returning crop residue or the regular addition of other organic material helps to improve fertility.

The use of this soil as pasture or hayland helps to control soil blowing. Overgrazing, however, causes surface compaction and reduces production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

284B—Flagler sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on stream benches and on uplands. Individual areas are irregular in shape and range from 2 to about 50 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is brown, very friable sandy loam about 10 inches thick. The substratum is dark yellowish brown loamy sand. In places on uplands, the subsoil and substratum have a slightly reddish cast.

Included with this soil in mapping are small areas of somewhat poorly drained Hoopeston soils along drainageways. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is slightly acid to strongly acid. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in most years. Soil blowing and water erosion are hazards in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, terraces, and winter cover crops help prevent soil loss. When terracing this soil, the depth of cuts should be held to a minimum to avoid exposing the sandy and gravelly material. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

284C—Flagler sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is mainly on the stream benches but also is on uplands in some areas. Individual areas are elongated and range from 2 to about 10 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown sandy loam about 4 inches thick. The subsoil is about 9 inches thick. It is brown, very friable sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose loamy sand containing some gravel. In places on uplands, the subsoil and substratum have a slightly reddish cast, and the content of clay is slightly higher in the subsoil.

Included with this soil in mapping are small areas of excessively drained Burkhardt soils and well drained Saude soils on landscape positions similar to those of this Flagler soil. The included soils make up about 5 to 7 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Surface runoff is medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction in the surface layer ranges from neutral to medium acid, depending on past liming practices. The subsoil is slightly acid to strongly acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, terraces, and winter cover crops help to prevent soil loss. When terracing this soil, the depth of cuts should be held to a minimum to avoid exposing the sandy and gravelly material.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

285C—Burkhardt sandy loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on stream benches and on ridge crests and side slopes on uplands. Slopes are mainly short. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is very dark brown sandy loam about 9 inches thick. The subsurface layer is dark brown sandy loam about 3 inches thick. The subsoil is brown, loose fine gravelly sandy loam about 5 inches thick. The substratum is brown and yellowish brown, stratified gravelly loamy sand and gravelly sand.

Included with this soil in mapping and on landscape positions similar to this Burkhardt soil are a few outcrops of gravelly sand. The outcrops have lower available water capacity. They make up less than 8 percent of mapped areas.

This soil has low available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The subsoil and upper part of the substratum ranges from slightly acid to strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Some areas of this soil are used for cultivated crops. Many areas are in pastureland. This droughty soil has poor suitability for corn and soybeans and fair suitability for small grains and for hay and pasture. Because of the low available water capacity, the plant population should be maintained at less density than for most other soils. Soil blowing and water erosion are hazards in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, terraces, and winter cover crops help to prevent soil loss. Terrace construction exposes the sandy and gravelly material. Returning crop residue or the regular addition of other organic materials helps to improve fertility and reduce erosion.

The use of this soil as pasture or hayland helps to control soil blowing and water erosion. Overgrazing pasture increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing during dry periods help to keep the pasture in good condition.

This soil is moderately suited to trees, but wooded areas are mainly limited to groves and trees around farmsteads. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards for planting or harvesting trees.

This soil is in capability subclass IVs.

350—Waukegan silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream benches. Individual areas are irregular in shape and range from 3 to about 50 acres.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable silt loam; and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is loamy sand and gravelly coarse sand.

Included with this soil in mapping are small areas of Saude and Waukee soils. The Saude and Waukee soils are on landscape positions similar to those of this Waukegan soil but have lower available water capacity. The included soils make up less than 10 percent of mapped areas.

This soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. The reaction is medium acid or slightly acid in the subsoil. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to slight droughtiness in years of average rainfall. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

354—Aquolls, ponded. This nearly level, very poorly drained soil is in depressional areas on bottom land and low benches adjacent to major streams and rivers and in shallow depressions on uplands. It is subject to ponding by runoff from adjacent areas. Individual areas are irregular in shape and range from 3 to 20 acres.

Typically, the surface layer is black silty clay loam or clay loam about 10 inches thick. The subsurface layer is black, very dark gray, or dark gray silty clay loam, loam, or sandy loam about 30 inches thick. The substratum to a depth of about 60 inches is very dark gray, dark gray, or gray silty clay loam, clay loam, loam, sandy loam, or loamy sand.

Permeability is variable but is commonly moderately slow, slow, or very slow. Available water capacity is generally moderate or high. In most areas either small ponds are evident, or the water table is at or near the surface the year-round. Organic matter content varies from about 4 to 12 percent.

Most areas are idle or used as wildlife habitat. This soil is generally not suited to cultivated crops or to grasses and legumes for hay and pasture. Providing drainage is very difficult because good outlets are not available. Most areas are suitable for wetland wildlife habitat.

This soil is in capability subclass VIIw.

377B—Dinsdale silty clay loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex, upland ridge crests and side slopes. Individual areas are irregular in shape and range from 2 to 70 acres.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, very friable sandy loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 73 inches is yellowish brown, mottled loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. The included soils make up less than 3 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The reaction is medium acid in the upper part of the subsoil and slightly acid or medium acid in the lower part. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Water erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. Controlling erosion is the major concern for cultivated crops. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and reduce erosion.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

377C2—Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is very dark grayish brown silty clay loam about 8 inches thick. It has been mixed with the upper part of the brown silty clay loam subsoil by plowing. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, very friable sandy loam; and the lower part is yellowish brown, mottled, firm loam. The

substratum to a depth of about 73 inches is yellowish brown, firm loam.

Included with this soil in mapping are small areas of soils that have dense, gray clay at a depth of about 20 to 36 inches. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The reaction is medium acid in the upper part of the subsoil and slightly acid or medium acid in the lower part. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion is the major concern for cultivated crops. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and reduce erosion. When terracing this soil, the exposure of glacial till should be held to a minimum because of the low fertility and unfavorable tilth of the exposed subsoil.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on uplands. It is on broad ridge crests and on long, slightly concave to very slightly convex slopes in and adjacent to drainageways and at the heads of drainageways. Individual areas are irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is about 25 inches thick. The upper part is olive gray and olive brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, calcareous loam.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. Content of organic matter in the surface layer is about 6 or 7 percent. Reaction is neutral in the surface layer and subsoil and is mildly alkaline in the substratum. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available. Returning crop residue and not tilling the soil when it is wet help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

391B—Clyde-Floyd complex, 1 to 4 percent slopes. This complex consists of nearly level and gently sloping, poorly drained and somewhat poorly drained soils on lower upland side slopes and drainageways. Typically, individual areas are long and narrow. They range from 3 to 30 acres or more. This complex is about 50 to 60 percent Clyde soils and 30 to 40 percent Floyd soils. In most places, Clyde soils are in the center of the drainageways, and Floyd soils are in a band bordering the drainageways. Areas of these soils are so intricately mixed or so small that to separate them in mapping was not practical.

Typically, the surface layer of the Clyde soils is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam and very dark gray, mottled clay loam about 14 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, mottled, friable clay loam; the middle part is light olive brown, friable loam with grayish brown mottles; and the lower part is yellowish brown, very friable sandy loam with light olive brown mottles. The substratum to a depth of about 60 inches is stratified, yellowish brown sandy clay loam with gray mottles and pale brown loam and loamy sand with olive brown mottles. Below this is strong brown loam mottled with gray.

Typically, the surface layer of the Floyd soil is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 15 inches thick. The subsoil is about 32 inches thick. The upper part is olive brown, mottled, friable loam; the middle part is light olive brown, mottled, friable sandy clay loam; and the lower part is yellowish brown and grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, mottled loam.

The soils in this complex have high available water capacity and are moderately permeable. They have a seasonal high water table. Runoff is slow, and the soils receive runoff and seepage from adjacent slopes. Content of organic matter in the surface layer of the

Clyde soil is about 8 to 10 percent, and in the surface layer of the Floyd soil it is about 5 or 6 percent. The reaction in the surface layer in both soils is slightly acid or neutral, depending on past liming practices. The subsoil is neutral or slightly acid and is very low in available phosphorus and potassium. These soils have good tilth.

Most areas of these soils are drained by tile and are used for cultivated crops. This complex is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available. Returning crop residue and not tilling the soil when it is wet help to maintain good tilth. Overgrazing pasture or grazing when the soil is too wet can cause surface compaction and poor tilth.

This complex is in capability subclass IIw.

394—Ostrander loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridge crests high on uplands and on benchlike positions on lower parts of uplands. In many of the lower lying positions, limestone bedrock is below a depth of 5 to 12 feet. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable loam; the middle part is brown and yellowish brown, friable sandy clay loam and sandy loam; and the lower part is brown, firm loam. The substratum to a depth of about 72 inches is stratified and mixed, strong brown and grayish brown sandy clay loam and clay loam.

Included with this soil in mapping are small areas of Rockton soils that are underlain by hard, bedded limestone. The Rockton soils are on landscape positions similar to those of this Ostrander soil. They make up 2 to 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is mainly medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

394B—Ostrander loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on long, convex ridge crests and side slopes on uplands. It is mainly on the lower end of downslope positions but is on the highest positions in a few areas. Individual areas are irregular in shape and range from 2 to 100 acres or more.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable sandy clay loam and sandy loam; and the lower part is brown, firm loam. The substratum to a depth of about 72 inches is stratified and mixed, strong brown and grayish brown sandy clay loam and clay loam.

Included with this soil in mapping are small areas of Flagler and Rockton soils. The Flagler and Rockton soils are on landscape positions similar to those of this Ostrander soil. They have lower available water capacity than the Ostrander soil. Small areas of somewhat poorly drained Floyd soils are along waterways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. Content of organic matter in the 8-inch surface layer is about 3 or 4 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is mainly medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the exposure of the subsoil should be held to a minimum because of the low fertility of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

394C—Ostrander loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex

side slopes on uplands. Individual areas are generally elongated and range from 2 to about 15 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 34 inches thick. The upper part is brown, friable loam; the middle part is brown and yellowish brown, friable sandy clay loam and sandy loam; and the lower part is brown and yellowish brown, firm loam. The substratum to a depth of about 72 inches is yellowish brown, mottled loam.

Included with this soil in mapping and on landscape positions similar to those of this Ostrander soil are small areas of somewhat excessively drained Flagler soils. Small areas of somewhat poorly drained Floyd soils are along waterways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is mainly medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the exposure of the subsoil should be held to a minimum because of the low fertility of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

394C2—Ostrander loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on short, convex side slopes on uplands. Individual areas are generally elongated and range from 2 to about 15 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. It has been mixed with the upper part of the brown loam subsoil. The subsoil is about 32 inches thick. The upper part is brown, friable loam; the middle part is brown and yellowish brown, friable sandy clay loam and sandy loam; and the lower part is brown and yellowish brown, firm loam. The substratum to a depth of about 72 inches is yellowish brown, mottled loam.

Included with this soil in mapping and on landscape positions similar to those of this Ostrander soil are small areas of somewhat excessively drained Flagler soils. Small areas of somewhat poorly drained Floyd soils are along waterways. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. Content of organic matter in the surface layer is 2 or 3 percent. Typically, the reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is mainly medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, the exposure of the subsoil should be held to a minimum because of the low fertility of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

398—Tripoli silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad ridge crests and at the heads of drainageways on uplands. Individual areas are irregular in shape and range from 10 to 200 acres or more.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is grayish brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 6 or 7 percent. The reaction is neutral in the surface layer. It is neutral or mildly alkaline in the subsoil and substratum. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available. Returning crop residue and not tilling the soil when it is wet help to maintain good tilth. Overgrazing pasture or grazing when the soil is wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

399—Readlyn silty clay loam, 1 to 3 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 5 to 200 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is dark grayish brown, friable, mottled silty clay loam; the middle part is yellowish brown, mottled, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow, mottled, calcareous loam.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 4 to 6 percent. The reaction is slightly acid or neutral in the surface layer, depending on past liming practices. The reaction ranges from slightly acid or medium acid in the upper part of the subsoil to neutral in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic matter helps to improve fertility and maintain good tilth.

Not all areas of this soil require tile. However, tile drainage improves the timeliness of field operations in some areas. The more sloping areas of this soil used for cropland are subject to slight erosion.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

404—Thorp silt loam, 0 to 1 percent slopes. This level, poorly drained soil is in slight depressions on stream benches. It is subject to ponding. Individual areas are irregular in shape and range from 2 to 10 acres.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is dark gray silt loam about 13 inches thick. The subsoil is about 23 inches thick. The upper part is gray, mottled, friable silty clay loam; and the lower part is gray, mottled, friable silty clay loam. The substratum to a depth of about 72 inches is olive gray, mottled silt loam. In places, the surface layer is black clay loam. In places, the subsoil is silty clay.

This soil has high available water capacity. It has a seasonal high water table. Permeability is moderately slow in the upper part of the profile and slow below that. Surface runoff is very slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction in the surface layer is slightly acid or neutral, depending on past liming practices. Reaction in the subsurface layer is slightly acid or medium acid and in the subsoil is medium acid or strongly acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are drained by tile and are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains generally work well in most places if good outlets are available. In places, surface drainage is needed to remove ponded water. Returning crop residue and not tilling the soil when it is wet helps maintain good tilth. Overgrazing pasture or grazing when the soil is wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

407B—Schley silt loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on uplands on concave foot slopes adjacent to drainageways. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, mottled, friable loam; the middle part is yellowish brown, mottled, very friable sandy loam; and the lower part is strong brown and grayish brown, mottled, friable sandy clay loam. The substratum to a depth of about 80 inches is strong brown and light brownish gray, mottled, stratified loam and sandy clay loam.

Included with this soil in mapping are small areas of poorly drained Clyde soils in the drainageways and small spots of clayey Donnan soils on the higher, more convex slopes. The included soils make up 5 to 8 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. Surface runoff is slow, and the soil receives runoff

from adjacent soils. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The subsurface layer and upper part of the subsoil is medium acid to strongly acid. The lower part of the subsoil is slightly acid or medium acid. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are drained by tile and are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic matter helps to improve fertility and maintain good tilth.

Wetness, especially in spring and during rainy periods, is the major limitation of this soil for cultivated crops. Some areas are subject to slight erosion when cropped. Wetness is due in part to sidehill seeps. A drainage system that intercepts the lateral movement of water is the most successful.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Special problems are not evident in the planting of new stands if suited species are selected and management is proper.

This soil is in capability subclass IIw.

408B—Olin fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained and somewhat excessively drained soil is on long, smooth and slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to about 5 acres.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is very dark brown fine sandy loam about 8 inches thick. The subsoil is 29 inches thick. The upper part is dark brown fine sandy loam; the middle part is yellowish brown sandy loam; and the lower part is olive brown, mottled clay loam. The substratum to a depth of about 72 inches is yellowish brown, mottled loam. In a few places, the soil is sandy loam to a depth of 60 inches.

This soil has high available water capacity. Permeability is moderately rapid in the upper part of the subsoil and moderate in the lower part and the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from neutral to medium acid in the surface layer, depending on past liming practices. The lower part of the surface layer and the subsoil are slightly acid or medium acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, terraces, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and adequately draining this soil are the major concerns in management. Overcoming erosion and wetness are difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The extra infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

408C—Olin fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained and somewhat excessively drained soil is on long, smooth, and slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to about 30 acres.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is very dark brown fine sandy loam about 5 inches thick. The subsoil is 29 inches thick. The upper part is dark brown fine sandy loam; the middle part is yellowish brown sandy loam; and the lower part is olive brown, mottled clay loam. The substratum to a depth of about 72 inches is yellowish brown, mottled loam. In a few places, the soil is sandy loam to a depth of 60 inches.

This soil has high available water capacity. The permeability is moderately rapid in the upper part of the subsoil and is moderate in the lower part and the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from neutral to medium acid in the plow layer, depending on past liming practices. The lower part of the surface layer and the subsoil are slightly acid or medium acid. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, terraces, and winter cover crops help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and adequately draining this soil are the major concerns in management. Overcoming these limitations is difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water but increase infiltration. The extra infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of low fertility and unfavorable tilth in the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

412C—Sogn loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, somewhat excessively drained soil is on upland side slopes and on stream benches. Individual areas are irregular in shape and range from 2 to about 20 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. It has a few small limestone fragments. The subsurface layer is very dark grayish brown clay loam about 4 inches thick. Fragmented limestone bedrock is at a depth of about 12 inches. In places, the depth to limestone bedrock is 20 to 30 inches.

This soil has very low available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from slightly acid to mildly alkaline. This soil is very low in available phosphorus and potassium. It has good tilth, although outcrops of limestone interfere with cultivation in places.

Most areas of this soil are used for pastureland. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture because it is very droughty. Crop production depends on the amount and timeliness of rainfall. Water erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent excessive soil loss. In places, farming on the contour is beneficial. Terrace construction is very difficult because of the shallow depth to limestone bedrock. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Because this soil is so shallow, it is easily overgrazed and susceptible to erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

412F—Sogn loam, 9 to 30 percent slopes. This strongly sloping to very steep, somewhat excessively drained soil is on side slopes on uplands and on stream benches. Individual areas are generally long and narrow and range from 2 to about 20 acres.

Typically, the surface layer is very dark brown loam about 6 inches thick. It has a few small limestone fragments. The subsurface layer is very dark grayish brown channery clay loam about 5 inches thick. Hard, fragmented limestone bedrock is at a depth of about 11 inches. Outcrops of limestone bedrock are in places.

This soil has very low available water capacity. The permeability is moderate. The surface runoff is rapid. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from slightly acid to mildly alkaline. The subsoil is very low in available phosphorus and potassium. This soil has good tilth.

Most areas of this soil are used as pastureland. This soil is not suited to cultivated crops because of the steepness of slope and shallowness to limestone bedrock. The use of this soil as pasture or hayland helps to control erosion (fig. 15). Because this soil is so shallow, pasture is easily overgrazed. Overgrazing increases the susceptibility to erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass VIIs.

428B—Ely silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is in long narrow bands at the foot of hillsides or on alluvial fans. Individual areas are irregular in shape and range from 5 to 50 acres.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam in the upper part and very dark grayish brown silty clay loam in the lower part. It is about 21 inches thick. The subsoil is about 20 inches thick. The upper part is brown and very dark grayish brown, mottled, friable silty clay loam. The middle part is olive brown, mottled, friable silty clay loam. The lower part is grayish brown, mottled, friable silty clay loam. The substratum to a depth of about 74 inches is grayish brown silt loam that has a few mottles.

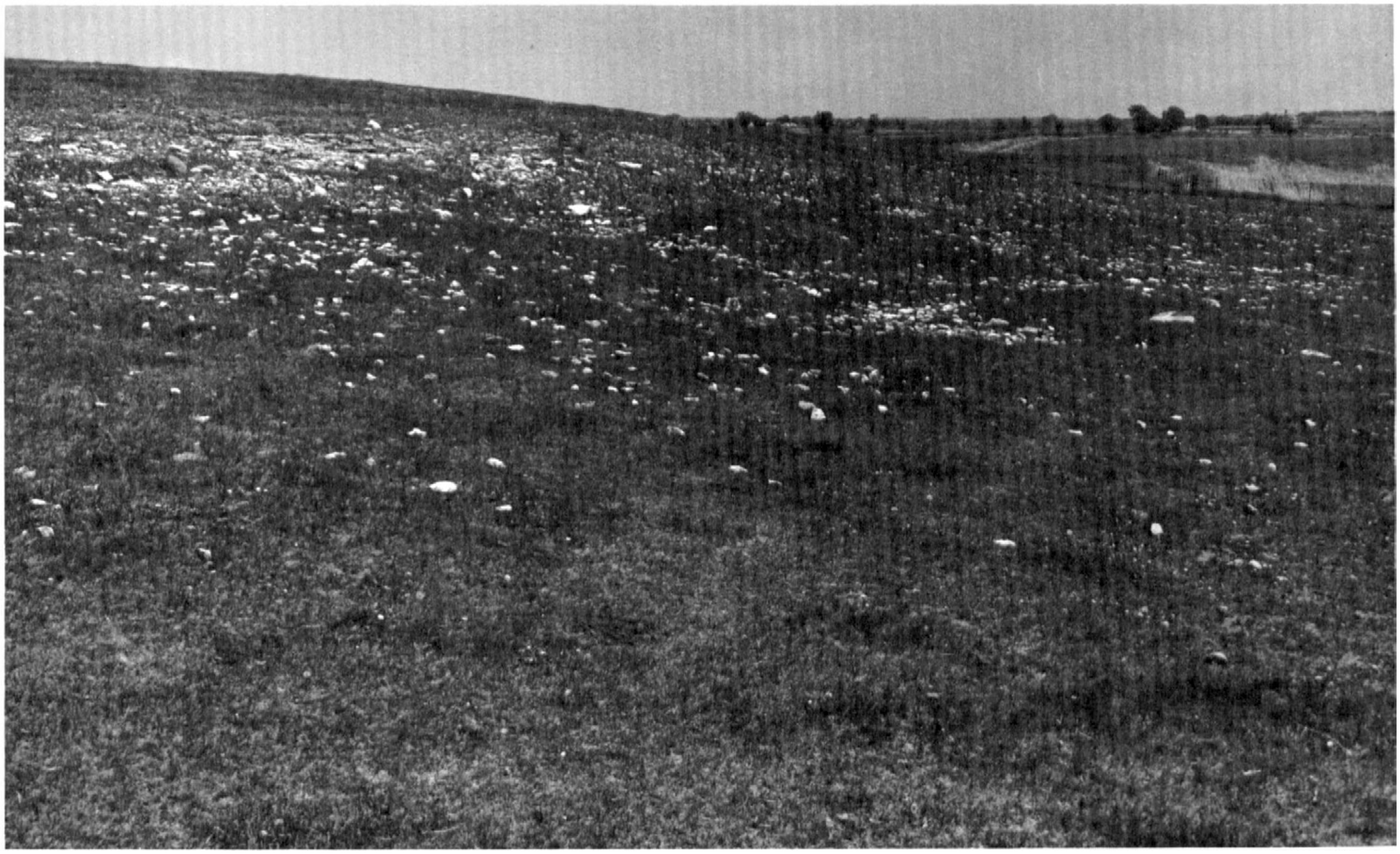


Figure 15.—Outcrop of limestone bedrock in Sogn soils. These soils are difficult to farm.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. Surface runoff from cultivated areas is medium. Content of organic matter in the surface layer is about 5 or 6 percent. The reaction is neutral or slightly acid in the surface layer, depending on past liming practices. The subsoil is slightly acid or neutral and is very low in available phosphorus and potassium. The soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Interceptor tile helps to remove the excess seepage from adjacent slopes. Where runoff concentrates, areas are subject to gully erosion. Diversion terraces are needed in these areas to intercept runoff. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

430—Ackmore silt loam, 1 to 3 percent slopes. This nearly level and very gently sloping, poorly drained soil is on narrow flood plains and alluvial fans. It is subject to flooding. Individual areas are irregular in shape and range from about 4 to 50 acres.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the substratum is thinly stratified, very dark gray and grayish brown silt loam that is underlain by stratified, black and grayish brown silt loam. Below this to a depth of about 76 inches the substratum is black silty clay loam.

This soil has very high available water capacity and is moderately permeable. It has a seasonal high water table. Surface runoff is slow. Content of organic matter

in the surface layer is about 2 to 3 percent. The reaction is neutral or slightly acid in the surface layer and subsoil. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Some areas of this soil are drained by tile and are cultivated. Most areas are undrained and are in pastureland. Where properly drained, this soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic materials helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Special problems are not evident in the planting of new stands if proper species are selected and management is proper.

This soil is in capability subclass IIw.

457—Du Page loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains. It is subject to flooding. Individual areas are irregular in shape and range from 15 to 100 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black and very dark brown, calcareous loam and silt loam about 58 inches thick. The substratum to a depth of about 98 inches is dark gray, mottled loam. In places, the surface layer is sandy loam or loamy sand.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. Content of organic matter in the surface layer is about 4 to 6 percent. The reaction is mildly alkaline or moderately alkaline. The subsoil is low in available phosphorus and very low in available potassium. Generally, this soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses for hay and pasture. Flooding is a hazard in areas of cultivated cropland and results in some crop loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained or somewhat poorly drained soil is on flood plains and in upland drainageways. It is subject to flooding. Individual areas are irregular in shape on the flood plains and are long and narrow in the upland drainageways. They range from 10 to 100 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black loam about 47 inches thick. The substratum to a depth of about 68 inches is very dark grayish brown, mottled loam. In places, the surface soil is black sandy loam.

Included with this soil in mapping are small areas of calcareous Du Page soils at a slightly lower elevation than this Spillville soil. The included soils make up less than 8 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. It has a seasonal high water table. Surface runoff is slow. Content of organic matter in the surface layer is about 4 to 6 percent. The reaction is slightly acid or neutral, and this soil seldom needs liming. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses for hay and pasture. Flooding is a hazard in areas of cultivated cropland and results in some crop loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

585—Spillville-Coland complex, 0 to 2 percent slopes. This complex consists of nearly level, poorly drained to moderately well drained soils on flood plains of rivers and streams and on low stream benches. These soils are subject to flooding. Individual areas are irregular in shape and range from about 5 to 200 acres or more. This complex is about 45 percent Spillville soils and 40 percent Coland soils. Areas of these soils are so intricately mixed or so small that to separate them in mapping was not practical. The Coland soils are in the lower lying areas, and the Spillville soils are in very slightly higher lying areas.

Typically, the surface soil of the Spillville soils is black loam about 55 inches thick. The substratum to a depth of about 68 inches is very dark grayish brown loam that has a few brown mottles.

Typically, the surface layer of the Coland soils is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 34 inches thick. The substratum to a depth of about 66 inches is stratified, very dark gray, mottled sandy clay loam and sandy loam.

Included with these soils in mapping are small areas of Dickinson, Hoopeston, Flagler, and Sparta soils. These soils are more sloping than the Spillville and Coland soils and are at a slightly higher elevation. The included soils make up 10 to 15 percent of mapped areas.

Available water capacity is very high in the Spillville soils and high in the Coland soils. Permeability is moderate in both soils. These soils have a seasonal high water table. Surface runoff is slow, and a few areas are ponded. Content of organic matter in the surface layer of the Spillville soils is 4 to 6 percent and is 5 to 7 percent in the Coland soils. The reaction ranges from neutral to slightly acid in both soils. These soils have good tilth.

Most areas of these soils are in woodland or pastureland. If drained and protected from flooding, this complex is suited to corn, soybeans, and small grains and to grasses for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants in the Coland soils. Drain tiles work well if good outlets are available. Levees are needed in places to reduce flooding of cropped areas. Returning crop residue and not tilling the soil when it is wet help to maintain good tilth. Overgrazing pasture or grazing when the soils are too wet can cause surface compaction and poor tilth.

This complex is in capability subclass IIIw.

621—Houghton muck, 0 to 2 percent slopes. This nearly level, very poorly drained soil is in drainageways on uplands and on stream benches and flood plains. It is subject to ponding. Individual areas are irregular in shape. Typically, they are 2 to 5 acres but range to as much as 40 acres.

Typically, the surface layer is black sapric material about 8 inches thick. The subsurface layer is black sapric material about 57 inches thick. The substratum to a depth of about 75 inches is black mucky silt loam.

Included with this soil in mapping are areas of Palms soils. The Palms soils are on landscapes similar to those of this Houghton soil and have an organic layer 16 to 50 inches thick. The included soils make up 5 to 8 percent of mapped areas.

This soil has very high available water capacity. The permeability is moderately slow to moderately rapid. Content of organic matter in the surface layer is 30 to 45 percent. This soil is neutral or moderately alkaline and seldom or never needs liming. The subsurface layer is very low in available phosphorus and potassium. Undrained areas are hummocky unless they have been leveled.

Most areas of this soil are left idle. If drained by tile, this soil is suited to corn and soybeans and to grasses for hay and pasture. Lodging of small grains is a problem on this soil. Undrained areas are poorly suited to pasture. Adequate drainage is difficult; tile lines settle and are difficult to maintain. Interceptor tile is needed to drain seepage. In many places, adjoining soils on higher positions have a sand and gravel substratum.

This soil is in capability subclass IIIw.

662D—Mt. Carroll silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on side slopes on uplands. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 27 inches thick. It is dark yellowish brown, friable silt loam. The mottled substratum to a depth of about 72 inches is dark yellowish brown and light olive gray, calcareous silt loam. In places, the surface layer is brown silt loam.

Included with this soil in mapping are a few areas of soils near Austinville and Aplington that have limestone bedrock at a depth of 30 to 50 inches. The included soils make up less than 5 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. The surface runoff is rapid. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction is medium acid or slightly acid in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are in woodland or pasture. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

662D3—Mt. Carroll silt loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on side slopes on uplands. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It has been mixed with dark yellowish brown silt loam from the upper part of the subsoil. The subsoil is dark yellowish brown, friable silt loam about 21 inches thick. The substratum to a depth of about 72 inches is dark yellowish brown, calcareous silt loam. In places, the surface layer is very dark gray silt loam.

Included with this soil in mapping are a few areas of soils near Austinville and Aplington that have limestone bedrock at a depth of 24 to 40 inches. The included soils make up less than 5 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. The surface runoff is rapid. Content of organic matter in the surface layer is less than 0.5 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is medium acid or slightly acid. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss (fig. 16). Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or

Figure 16.—Stripcropping on severely eroded Mt. Carroll soils. Conservation practices are necessary to prevent further serious erosion on these highly erodible soils.

girdling. There are no other hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IVe.

662F—Mt. Carroll silt loam, 14 to 25 percent slopes. This moderately steep and steep, well drained soil is on side slopes on uplands. Individual areas are generally elongated and range from 2 to 15 acres.

Typically, the surface layer consists of dark brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 26 inches thick. It is dark yellowish brown, friable silt loam. The substratum to a depth of about 72 inches is dark yellowish brown, calcareous silt loam. In places, the surface layer is brown silt loam.

Included with this soil in mapping are a few areas of soils near Austinville and Aplington that have limestone below a depth of 20 to 40 inches. The included soils make up less than 5 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. The surface runoff is rapid. Content of organic matter in the surface layer is about 2 or 3 percent. Typically, reaction in the surface layer is slightly acid or neutral. The reaction is medium acid or slightly acid in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are in woodland or pasture. This soil is poorly suited to cultivated crops because of the steepness of slope. It is suited to grasses and legumes for hay and pasture and is suited to trees.

This soil is in capability subclass VIe.

662F3—Mt. Carroll silt loam, 14 to 25 percent slopes, severely eroded. This moderately steep and steep, well drained soil is on side slopes on uplands. It is generally dissected by small waterways. Individual areas are generally elongated and range from 2 to 15 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It has been mixed with material from the upper part of the subsoil. The subsoil is about 27 inches thick. It is dark yellowish brown, friable silt loam. The substratum to a depth of about 72 inches is dark yellowish brown, calcareous silt loam and has light olive gray mottles. In places the surface layer is calcareous, and in places the subsoil is silty clay loam.

Included with this soil in mapping are a few small areas of soils near Austinville and Aplington that have limestone bedrock below a depth of 20 to 40 inches. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is rapid. Content of organic matter in the surface layer is less than 0.5 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. Reaction in the subsoil is medium acid or slightly acid. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Nearly all areas of this soil have been used for cultivated crops. This soil is poorly suited to cultivated crops because of the steepness of slope. It is suited to grasses and legumes for hay and pasture.

This soil is moderately suited to trees, and small areas remain in native hardwoods. Careful consideration should be given to the location of logging trails or roads to reduce the possibility of erosion. Laying out the trails or roads on the contour, or nearly on the contour, helps to reduce erosion. The slope of this soil is steep enough to be hazardous in the operation of equipment. Special equipment can be used, and caution should be exercised in their operation. Survival of seedlings or competition from undesirable plants is not expected to be a problem.

This soil is in capability subclass VIe.

713B—Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridge crests and side slopes on uplands. Individual areas are irregular in shape. They range from 2 to 20 acres but are generally 4 to 8 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable loam; the middle part is strong brown, firm loam; and the lower part is brown, very firm clay. Hard, shattered, level bedded limestone bedrock is at a depth of 35 inches. In places, the subsoil is thicker than this typical soil, and the depth to limestone is as much as 60 inches.

Included with this soil in mapping are small areas of Bassett soils. The Bassett soils are on landscape positions similar to those of this Winneshiek soil but do not have level bedded limestone in the profile. The included soils make up less than 5 percent of mapped areas.

This soil has moderate available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of below average rainfall. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

In some spots, terrace construction may be difficult because of the shallowness to limestone bedrock. When terracing this soil, cuts should be held to a minimum to avoid exposing the bedrock. In places, the bedrock interferes with terrace construction.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no other hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

714B—Winneshiek loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridge crests and side slopes on uplands. Individual areas are irregular in shape. They range from 2 to 60 acres but are generally 4 to 8 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsoil is about 15 inches thick. The upper part is dark yellowish brown, firm clay loam; and the lower part is strong brown, very firm clay. Hard, shattered, level bedded limestone bedrock is at a depth of 23 inches. In places, the depth to limestone is less than 20 inches.

This soil has low available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The reaction in the subsoil ranges from medium acid to neutral. The subsoil is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in cultivated cropland. Conservation tillage, which leaves crop residue on the surface, helps to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

When terracing this soil, cuts should be held to a minimum so that the underlying material is not exposed in the channel. In most places, the bedrock interferes with terrace construction.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no other hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

733—Calco silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom lands. It is subject to flooding. Individual areas are irregular in shape and range from 3 to 40 acres.

Typically, the surface layer is black, calcareous silty clay loam about 8 inches thick. The subsurface layer is black, calcareous silty clay loam about 24 inches thick. The subsoil is about 9 inches thick. It is grayish brown, friable silty clay loam. The mottled substratum to a depth of about 60 inches is strong brown and grayish brown silty clay loam underlain by dark grayish brown, dark gray, and strong brown fine sandy loam.

Included with this soil in mapping are areas of soils that are sand or loamy sand below a depth of about 32 to 40 inches and are on landscape positions similar to those of this Calco soil. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. It has a seasonal high water table. The surface runoff is slow. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction ranges from mildly acid to moderately alkaline. This soil has good tilth.

Many areas of this soil are drained by tile and are used for cultivated crops. If this soil is drained, it is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Adequate drainage is needed to reduce wetness and provide proper aeration and a deep root zone for plants. Tile drains work well if good outlets are available. Returning crop residue and not tilling the soil when it is wet help to maintain good tilth. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

771B—Waubeek silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; and the lower part is

yellowish brown, mottled, firm clay loam. The substratum to a depth of about 72 inches is strong brown, mottled, calcareous clay loam. In small areas, dense gray clay is below a depth of 20 to 36 inches.

This soil has high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction is neutral to medium acid in the surface layer, depending on past liming practices. The reaction is slightly acid or medium acid in the subsoil and ranges from slightly acid to mildly alkaline in the substratum. The subsoil is medium in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. Erosion is the major limitation. Controlling erosion is a concern in management. The uniform slopes are well suited to contour farming and terracing. These practices slow movement of surface water and reduce erosion.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

777—Wapsie loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to about 40 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, friable loam; and the lower part is dark yellowish brown and yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is strong brown loamy sand and sand. In places, the sandy substratum is at a depth of 32 to 40 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Flagler soils on landscape positions similar to those of this Wapsie soil. The included soils make up less than 5 percent of mapped areas.

This soil has low available water capacity. The permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is slow. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction is medium acid to neutral in the surface layer, depending on past liming practices. The subsoil is medium acid or strongly acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIs.

777B—Wapsie loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to about 25 acres.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is brown and dark yellowish brown, friable loam; and the lower part is yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is strong brown loamy sand and sand.

Included with this soil in mapping are small areas of well drained and somewhat excessively drained Dickinson and Lamont soils and somewhat excessively drained Flagler soils. These soils are on landscape positions similar to those of this Wapsie soil. The included soils make up less than 10 percent of mapped areas.

This soil has low available water capacity. The permeability is moderate in the subsoil and very rapid in the substratum. Surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction is medium acid to neutral in the plow layer, depending on past liming practices. The

subsoil is medium acid or strongly acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to droughtiness in years of average or below average rainfall. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth. When terracing this soil, depth of cuts should be held to a minimum to avoid exposing the sandy and gravelly material.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

781B—Lourdes loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, friable clay loam; the middle and lower parts are yellowish brown, firm clay loam. The substratum to a depth of about 72 inches is yellowish brown, calcareous clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Riceville soils along waterways. These soils are wetter and less sloping than this Lourdes soil. The included soils make up 5 to 8 percent of mapped areas.

This soil has high available water capacity, and permeability is moderately slow. Surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. Reaction is medium acid to neutral in the plow layer, depending on past liming practices. The reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to neutral or mildly alkaline in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage are major concerns in managing this soil. The practices are difficult, because they conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

781C2—Lourdes loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on slightly convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. It has been mixed with yellowish brown, friable loam from the upper part of the subsoil. The subsoil is about 33 inches thick. The upper part is yellowish brown friable loam; the middle and lower parts are yellowish brown, firm clay loam. The substratum to a depth of about 72 inches is mottled, yellowish brown and light gray clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Riceville soils along waterways. These soils are wetter and less sloping than this Lourdes soil. The included soils make up less than 5 percent of mapped areas.

This soil has high available water capacity, and permeability is moderately slow. The surface runoff is

medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction ranges from strongly acid or very strongly acid in the upper part of the subsoil to neutral or moderately alkaline in the lower part. The subsoil is very low in available phosphorus and potassium. This soil generally has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Controlling erosion and providing adequate drainage are major concerns in managing this soil. The practices are difficult because they conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIIe.

782B—Donnan loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained and moderately well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 44 inches thick. The upper part is dark yellowish brown, mottled, friable clay loam; the middle part is gray and dark gray, mottled, very firm clay; and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 72 inches is light olive brown loam. In some areas, the middle part of the subsoil is reddish brown, very firm clay.

Included with this soil in mapping are small areas of Floyd, Riceville, and Schley soils along waterways. These soils have less clay in the subsoil than this Donnan soil. The included soils make up less than 10 percent of mapped areas.

This soil has high available water capacity. The permeability is moderate in the upper part of the subsoil and is very slow in the middle and lower parts and in the substratum. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction ranges from medium acid to neutral in the plow layer, depending on past liming practices. The reaction is strongly acid or medium acid in the upper part of the subsoil and is medium acid or slightly acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is somewhat restricted below a depth of about 2 to 3 feet by the compact clay or clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are major concerns of management. The practices that overcome the limitations are difficult, because they conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The increased infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIe.

782C2—Donnan loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained and moderately well drained soil is on slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. It has been mixed with dark yellowish brown clay loam from the subsoil. The subsoil is about 37 inches thick. The upper part is dark yellowish brown and brown, mottled, friable loam; the middle part is gray and dark gray, mottled, very firm clay; and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 72 inches is light olive brown, mottled loam. In some areas, the middle part of the subsoil is reddish brown, very firm clay.

Included with this soil in mapping are small areas of Floyd, Riceville, and Schley soils along waterways. These soils have lower content of clay in the subsoil than this Donnan soil. The included soils make up 2 to 6 percent of mapped areas.

This soil has high available water capacity. The permeability is moderate in the upper part of the subsoil and is very slow in the middle and lower parts and in the substratum. The surface runoff is medium. Content of organic matter in the surface layer is about 1 or 2 percent. The reaction ranges from medium acid or neutral in the surface layer, depending on past liming practices. Reaction is strongly acid or medium acid in the upper part of the subsoil and medium acid or slightly acid in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact clay or clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are major concerns of management. Overcoming these limitations are difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The increased infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IVe.

783B—Cresco loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, smooth and slightly convex ridge crests and side slopes on uplands. Individual areas are irregular in shape and range from 2 to 100 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 72 inches is yellowish brown, mottled, very firm, calcareous clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Protivin soils along waterways. The Floyd and Protivin soils are wetter than this Cresco soil and are less sloping. The included soils make up 5 to 8 percent of mapped areas.

This soil has high available water capacity, and permeability is moderately slow. The surface runoff is medium. Content of organic matter in the surface layer is about 4 or 5 percent. The reaction is medium acid to neutral in the plow layer, depending on past liming practices. Reaction is strongly acid in the upper part of the subsoil and is neutral or mildly alkaline in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are the major concerns in management. Overcoming the limitations are difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration. The increased infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be

needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

783C—Cresco loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short, slightly convex side slopes on uplands. Individual areas are elongated and range from 2 to 25 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is brown and yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 72 inches is yellowish brown, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Protivin soils along waterways. The Floyd and Protivin soils are wetter than this Cresco soil and are less sloping. The included soils make up 2 to 5 percent of mapped areas.

This soil has high available water capacity, and permeability is moderately slow. The surface runoff is medium. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction is medium acid to neutral in the surface layer, depending on past liming practices. Reaction is strongly acid in the upper part of the subsoil and is neutral or mildly alkaline in the lower part. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are the major concerns in management. Overcoming the limitations are difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water which increases infiltration. The increased infiltration complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

783C2—Cresco loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, slightly convex side slopes on uplands. Individual areas are elongated and range from 2 to 25 acres.

Typically, the surface layer consists of very dark grayish brown loam about 8 inches thick. It has been mixed with a small amount of brown clay loam from the subsoil. The subsoil is about 26 inches thick. The upper part is brown and yellowish brown, friable clay loam; the lower part is yellowish brown, very firm clay loam mottled with gray and grayish brown. The substratum to a depth of about 72 inches is yellowish brown and gray, calcareous clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Protivin soils along waterways. The Floyd and Protivin soils are wetter than this Cresco soil and are less sloping. The included soils make up about 2 to 5 percent of mapped areas.

This soil has high available water capacity, and permeability is moderately slow. The surface runoff is medium. Content of organic matter in the surface layer is about 2 or 3 percent. The reaction is medium acid to neutral in the surface layer, depending on past liming practices. The reaction is strongly acid in the upper part of the subsoil and is neutral and mildly alkaline in the lower part. The subsoil is very low in available phosphorus and potassium. This soil generally has good tilth. The plow layer is commonly acid if it has not been limed in the past 5 years. Root development is somewhat restricted below a depth of about 2 feet by the compact clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are the main concerns of management. Overcoming these limitations are difficult because the practices conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the

movement of surface water, which increases infiltration and complicates drainage, especially in wet periods. A combination of terracing and tiling may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

784B—Riceville loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on long, slightly concave and slightly convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown and dark grayish brown, mottled, friable clay loam; the middle part is yellowish brown and gray, mottled, very firm clay loam; the lower part is mottled light olive brown and olive gray, very firm clay loam. The substratum to a depth of about 60 inches is light olive brown and gray, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of poorly drained Clyde soils along waterways. The included soils make up about 5 to 7 percent of mapped areas.

This soil has high available water capacity. It has a seasonal high water table. Permeability is moderately slow. The surface runoff is slow or medium, and this soil receives runoff from higher lying adjacent soils. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from neutral to strongly acid in the surface layer, depending on past liming practices. Reaction is strongly acid or very strongly acid in the upper part of the subsoil and is strongly acid to neutral in the middle and lower parts. The subsoil is very low in available phosphorus and potassium. This soil has good tilth. Root development is restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic matter helps to improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are difficult on this soil because the practices that overcome the limitations conflict to some extent. The uniform slopes are well suited to contour farming and terracing. These practices slow the movement of surface water and increase infiltration, which complicates drainage, especially in wet periods. A combination of tiling and terracing may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

Because of the slow movement of water through the middle and lower parts of the subsoil, wetness and seepage are problems in wet seasons. Tile drainage is beneficial during these times. A drainage system that is designed to intercept laterally moving water will be most successful in draining this soil. Tile drains do not always function well and may need closer spacing than on soils that are more permeable.

The use of this soil as pasture or hayland helps control erosion. Overgrazing pasture or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations for planting or harvesting trees.

This soil is in capability subclass IIw.

798B—Protivin clay loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on long, slightly concave and slightly convex side slopes on uplands. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown clay loam about 14 inches thick. The subsoil is about 34 inches thick. The upper part is mottled, light olive brown and grayish brown, friable clay loam; and the lower part is mottled, yellowish brown and gray, very firm clay loam. The substratum to a depth of about 72 inches is mottled, yellowish brown and gray, calcareous clay loam.

Included with this soil in mapping are small areas of poorly drained Clyde soils along waterways. The included soils make up 5 to 10 percent of the mapped areas.

This soil has high available water capacity. It has a seasonal high water table. Permeability is moderately slow. The surface runoff is slow or medium, and this soil receives runoff from adjacent soils. Content of organic matter in the surface layer is about 5 to 7 percent. The reaction is slightly acid or neutral in the surface layer,

depending on past liming practices. Reaction ranges from slightly acid or medium acid in the upper part of the subsoil to neutral in the lower part. The subsoil is very low in available phosphorus and potassium. Generally, this soil has good tilth. Root development is somewhat restricted below a depth of about 2 feet by the compact clay loam glacial till.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help prevent soil loss. Returning crop residue or the regular addition of other organic matter helps improve fertility and maintain good tilth.

Providing erosion control and adequate drainage are the main concerns in management. Overcoming these limitations are difficult because the practices conflict to some extent. The uniform slopes are well suited to farming on the contour and terracing. These practices slow the movement of surface water, which increases infiltration and complicates drainage, especially in wet periods. A combination of tiling and terracing may be needed. When terracing this soil, the exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the exposed materials.

Because of the slow movement of water through the middle and lower parts of the subsoil, wetness and seepage are problems in wet seasons. Tile drainage is beneficial during these times. A drainage system that is designed to intercept laterally moving water will be most successful in draining this soil. Tile drains do not always function well and may need closer spacing than on soils that are more permeable.

The use of this soil for pasture or hayland helps to control erosion. Overgrazing pasture or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

976—Raddle silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is dark brown, friable silt loam; and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam and gray, firm silty clay loam. Below this to a depth of about 80 inches, the substratum is loamy coarse sand and has few to many pebbles.

Included with this soil in mapping are small areas of Dickinson and Bolan soils. The Bolan and Dickinson soils are on landscape positions similar to those of this Raddle soil and have a higher sand content. The included soils make up about 2 percent of mapped areas.

This soil has high available water capacity and is moderately permeable. The surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The subsoil is slightly acid or medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

976B—Raddle silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is brown, friable silt loam; and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 50 inches is yellowish brown, friable silt loam and gray, firm silty clay loam. Below this to a depth of about 80 inches, the substratum is loamy coarse sand and has few to many pebbles.

Included with this soil in mapping are small areas of Dickinson and Bolan soils. The Bolan and Dickinson soils are on landscape positions similar to those of this Raddle soil and have a higher sand content. The included soils make up less than 5 percent of mapped areas.

This soil has very high available water capacity and is moderately permeable. The surface runoff is slow. Content of organic matter in the surface layer is about 3 or 4 percent. The reaction ranges from medium acid to neutral in the surface layer, depending on past liming practices. The subsoil is slightly acid or medium acid and is low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains

and to grasses and legumes. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing pasture when the soil is too wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

981B—Worthen silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on uplands on plane and slightly convex foot slopes and on convex alluvial fans. Individual areas are irregular in shape and range from 3 to 80 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 11 inches thick. The subsoil is friable silt loam about 35 inches thick. The upper part is very dark grayish brown, the middle part is brown, and the lower part is dark yellowish brown, mottled silt loam. In places, the surface layer is brown silt loam.

This soil has very high available water capacity and is moderately permeable. The surface runoff is medium. Content of organic matter in the surface layer is about 4 or 5 percent. The reaction is slightly acid or neutral in the surface layer, depending on past liming practices. The subsoil is slightly acid. It is medium to low in available phosphorus and very low in available potassium. This soil has good tilth.

Most areas of this soil are used for cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in areas of cultivated cropland. Conservation tillage, which leaves crop residue on the surface, and terraces help to prevent soil loss. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of this soil as pasture or hayland helps to control erosion. Overgrazing, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is in capability subclass IIe.

1585—Spillville-Coland complex, channeled, 0 to 2 percent slopes. This complex consists of nearly level, poorly drained to moderately well drained, loamy soils on bottom lands. These soils are subject to flooding. Individual areas are irregular in shape and range from about 50 to 500 acres or more. Many channels, closed depressions, natural levees, small oxbows, and a few marshes are in the areas. This unit is about 40 to 45 percent Spillville soils and 35 to 40 percent Coland soils. The Coland soils are on the lower lying positions, and the Spillville soils are on very slightly higher positions. Areas of these soils are so intricately mixed or so small that to separate them in mapping was not practical.

Typically, the surface layer of the Spillville soil is black loam about 8 inches thick. The subsurface layer is black loam about 47 inches thick. The substratum to a depth of about 68 inches is stratified, very dark gray sandy clay loam and sandy loam.

Typically, the surface layer of the Coland soil is black clay loam about 7 inches thick. The subsurface layer is black and very dark gray clay loam about 34 inches thick. The substratum to a depth of about 66 inches is stratified, very dark gray, mottled sandy clay loam and sandy loam.

Included with these soils in mapping are small areas of Dickinson, Flagler, Hoopeston, and Sparta soils that are better drained than Spillville and Coland soils and are on slightly higher positions. The included soils make up about 10 to 15 percent of mapped areas.

The soils in this complex have very high available water capacity. They have a seasonal high water table. Surface runoff is slow, and water is ponded in a few areas. Content of organic matter in the surface layer of the Spillville soils is 4 to 6 percent and in the Coland soils is 5 to 7 percent. The reaction is neutral or slightly acid in both soils. These soils have good tilth.

Most areas of these soils are in woodland or pasture. The complex is poorly suited to cultivated crops because it is channeled and subject to flooding. Some areas provide good habitat for waterfowl, muskrat, and other wetland wildlife.

This complex is in capability subclass Vw.

5010—Pits, sand and gravel. The pits in areas of this map unit result from the mining of sand and gravel for roads and construction purposes. They range from about 10 to 30 feet in depth. Piles of sand and gravel and spoil 10 to 30 feet or more in height surround the pits. The pits are irregular in shape and can have steeply sloping sidewalls. Some of the pits contain a few feet of water, and some contain more than 20 feet of water. Areas range from 2 to more than 70 acres.

The spoil surrounding the pits is variable in texture. Generally, it is about 40 to 70 percent sand and has a small amount of gravel. In a few places the spoil has been leveled and smoothed, and in places the spoil is irregular and very uneven. Places that are level are reasonably easy to vegetate to trees or grasses. Reaction of the spoil is variable but ranges from medium acid to mildly alkaline.

Abandoned pits in some areas have been smoothed and seeded to grasses. In some areas, they have been left in a roughened condition and have a dense growth

of brush, trees, grasses, and weeds. These pits have good potential for wildlife. Generally, the pits that contain water more than 3 feet deep support fish; most of these are shown on the map as water areas. The steepness of the side slopes of pits and the variable depth of the water are limitations for recreation and can be dangerous. Each site needs onsite investigation.

This map unit is not assigned to a capability subclass.

5030—Pits, limestone. The pits in areas of this map unit result from quarrying of limestone, mainly for roads, construction purposes, and agricultural lime. They range in depth from 20 to 40 feet or more. Piles of ground limestone 10 to 30 feet or more in height surround the pits. The pits are irregular in shape and range from 2 to 30 acres. They can have steep sidewalls. Some of the pits contain a few feet of water, and some contain many feet of water.

The spoil surrounding the pits is variable in texture; however, it is mainly loamy and contains varying amounts of limestone fragments. The spoil is loess, loam glacial till, or a mixture of the two. In a few places, the spoil has been leveled and smoothed; in other places the spoil is irregular and very uneven. Level areas are reasonably easy to vegetate to grasses or trees. Reaction of the spoil is variable but generally ranges from medium acid to mildly alkaline.

These areas have good potential for wildlife. The quarries that contain water support fish, but the steepness of the sidewalls and variable depth of the water are limitations to recreation and can be dangerous. Each site needs onsite investigation to determine its safety for recreation uses.

This map unit is not assigned to a capability subclass.

5040—Orthents, loamy. These are nearly level to strongly sloping soils that have been used as borrow areas for construction. In some areas the original soil has been removed to a depth of 5 to 20 feet or more. In some areas the topsoil has been redistributed. The internal drainage of these soils ranges from very rapid to very slow and is directly related to the kind of material from which the soils were derived and the condition to which the borrow area was restored. Generally, individual areas range from 6 to 50 acres.

Typically, yellowish brown, friable and firm loam extends to a depth of 60 inches. Cobbles and pebbles are common on the surface in many areas. In some areas, the texture is sandy loam. In some areas, 4 to 10 inches of topsoil has been redistributed over the borrow area, often unevenly, and the color of the surface ranges from very dark gray to dark brown.

Included with this soil in mapping are small areas of sand and a few covered dumps or landfills.

Orthents range from moderate to low in available water capacity. Permeability is variable and depends on texture and density of the soil. Soil that was once buried 5 to 20 feet or more beneath the surface has less pore space and higher density than the original surface layer. This previously buried material has not been appreciably affected by the process of soil development and freezing and thawing. Surface runoff from Orthents ranges from slow to rapid. The content of organic matter is very low, unless topsoil has been redistributed over the surface. For this reason, a good seedbed is difficult to obtain and drought stress appears more quickly. The total organic matter to a depth of 1 foot is typically less than 3 tons per acre. Typically, reaction is moderately alkaline. In most areas, Orthents are very low in available phosphorus and potassium.

Many areas of Orthents are not suited to cultivated crops. However, the areas where topsoil has been redistributed are better suited than the other areas and are used for corn and soybeans. Orthents are better suited to small grains and to grasses and legumes for hay and pasture than to most other crops. If they are cultivated, the hazard of erosion in sloping areas is moderate or severe. Conservation tillage and other measures that disturb the soil as little as possible and leave crop residue on the surface help stabilize this soil.

This map unit is not assigned to a capability subclass.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops. If it is properly treated and high level management and acceptable farming methods are used, prime farmland produces the highest yields with minimal inputs of energy and economic resources, and its use results in the least damage to the environment.

Prime farmland in Butler County can now be in cropland, pastureland, woodland, or other land uses but not in urbanland, built-up land, or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland generally has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season and acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with

water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 280,000 acres or nearly 75 percent of Butler County meets the soil requirements for prime farmland. Areas are throughout the county. Approximately 265,000 acres of this prime farmland is used for crops. Crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county's agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and are generally less productive.

Soil map units that make up prime farmland in Butler County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed soil map units."

Soils that have limitations—a high water table or flooding—may qualify for prime farmland if these limitations are overcome by such measures as drainage or flood control. In the following list, the measures used to overcome the limitations, if any, are shown after the map unit name. Onsite evaluation is necessary to see if these limitations have been overcome by corrective measures.

The map units that meet the soil requirements for prime farmland are:

430	Ackmore silt loam, 1 to 3 percent slopes[1,2]
171	Bassett loam, 0 to 2 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
174	Bolan loam, 0 to 2 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes[1]
733	Calco silty clay loam, 0 to 2 percent slopes[1]
84	Clyde silty clay loam, 0 to 3 percent slopes[1]
391B	Clyde-Floyd complex, 1 to 4 percent slopes[1]
135	Coland clay loam, 0 to 2 percent slopes[1]
201B	Coland-Terril complex, 1 to 4 percent slopes[1,2]
133	Colo silty clay loam, 0 to 2 percent slopes[1]
11B	Colo-Ely complex, 2 to 5 percent slopes[1]
783B	Cresco loam, 2 to 5 percent slopes
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
377B	Dinsdale silty clay loam, 2 to 5 percent slopes
782B	Donnan loam, 2 to 5 percent slopes
457	Du Page loam, 0 to 2 percent slopes
428B	Ely silt loam, 2 to 5 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
118	Garwin silty clay loam, 0 to 2 percent slopes[1]
150B	Hanska loam, 1 to 4 percent slopes[1]
173	Hoopeston fine sandy loam, 0 to 2 percent slopes
173B	Hoopeston fine sandy loam, 2 to 5 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
184	Klinger silty clay loam, 1 to 3 percent slopes
110B	Lamont fine sandy loam, 2 to 5 percent slopes
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
781B	Lourdes loam, 2 to 5 percent slopes
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes[1]
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes[1]
382	Maxfield silty clay loam, 0 to 2 percent slopes[1]
119	Muscatine silty clay loam, 1 to 3 percent slopes
88	Nevin silty clay loam, 0 to 2 percent slopes
408B	Olin fine sandy loam, 2 to 5 percent slopes
394	Ostrander loam, 0 to 2 percent slopes
394B	Ostrander loam, 2 to 5 percent slopes
798B	Protivin clay loam, 1 to 4 percent slopes
976	Raddle silt loam, 0 to 2 percent slopes
976B	Raddle silt loam, 2 to 5 percent slopes
399	Readlyn silty clay loam, 1 to 3 percent slopes
784B	Riceville loam, 1 to 4 percent slopes[1]
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
407B	Schley silt loam, 1 to 4 percent slopes[1]
153	Shandep clay loam, 0 to 1 percent slopes[1,2]
485	Spillville loam, 0 to 2 percent slopes[1]
585	Spillville-Coland complex, 0 to 2 percent slopes[1,2]
120	Tama silt loam, 0 to 2 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
27B	Terril loam, 2 to 5 percent slopes
404	Thorp silt loam, 0 to 1 percent slopes[1]
398	Tripoli silty clay loam, 0 to 2 percent slopes[1]
777	Wapsie loam, 0 to 2 percent slopes
777B	Wapsie loam, 2 to 5 percent slopes

771B Waubeek silt loam, 2 to 5 percent slopes
178 Waukee loam, 0 to 2 percent slopes
178B Waukee loam, 2 to 5 percent slopes
350 Waukegan silt loam, 0 to 2 percent slopes
713B Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
714B Winneshiek loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
981B Worthen silt loam, 2 to 5 percent slopes

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[1] Where drained sufficiently for cropland.
[2] Where flooding during growing season occurs once or less in 2 years.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

By Clarke R. Simmonds, conservationist, Soil Conservation Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1977, about 357,400 acres in the survey area was used for agricultural purposes according to the Iowa Agricultural Statistics. Of this total, approximately 27,730 acres was used for pasture; 258,920 acres was used for row crops, mainly corn and soybeans; 25,190 acres was used for close-growing crops, mainly oats and wheat; 22,900 acres was used for hay; and 22,660 acres was used for other purposes.

Good land use should be based on the properties and capabilities of the soils. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map units."

This soil survey can greatly facilitate the application of the latest technology to increase food production from existing cropland areas.

Soil erosion is the major hazard of crop production in Butler County. Slopes in excess of 2 percent have an erosion hazard. Loss of the surface layer through erosion is damaging for many reasons. Productivity can be affected because of the loss of fertilizers and other chemicals. Also, as the surface layer continues to become thinner, subsoil is incorporated into the plow layer. In severe cases of erosion, physical damage can occur to the growing crop by uprooting the plant or by burying it with sediment.

Erosion of the surface layer can cause pollution of streams and lakes by sediment and chemicals. By controlling erosion, water quality of streams and lakes can be improved for municipal use and recreation and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. Grass and legume forage crops in the rotation reduce erosion on sloping land, provide nitrogen for the following crops, and improve tilth.

Some soils have slopes that are so short, steep, and irregular that contour tillage or terracing is not practical.

Some areas of Mt. Carroll soils are in this category. On these soils cropping systems that provide substantial vegetative cover and conservation tillage are required to control erosion.

Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce runoff and erosion. These practices can be adapted to all tillable soils in the survey area. No-tillage of corn and soybeans effectively helps to control erosion in continuous cropland.

Terraces reduce the length of slope and reduce runoff and erosion. They are most adaptable and practical on well drained and moderately well drained soils that have long, smooth slopes and are gently sloping to moderately sloping. Gently sloping Dinsdale, Downs, and Tama soils are well suited to terracing.

Where terraces are built on soils that have a glacial till subsoil, such as Bassett, Cresco, and Kenyon soils, care should be taken not to expose the glacial till because of its low fertility and unfavorable tilth. Similar care should be taken where building terraces on soils that have sand and gravel or limestone in the subsoil or underlying material.

Contouring and contour stripcropping are effective as erosion control practices in Butler County. These practices are better suited to soils that have smooth, uniform slopes.

Soil blowing is a hazard on the sandy Burkhardt, Chelsea, Dickinson, Flagler, Lamont, Hoopeston, Olin, and Sparta soils (fig. 17). Soil blowing can damage these soils and the crops growing on them in a few hours if winds are strong and the soil is dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

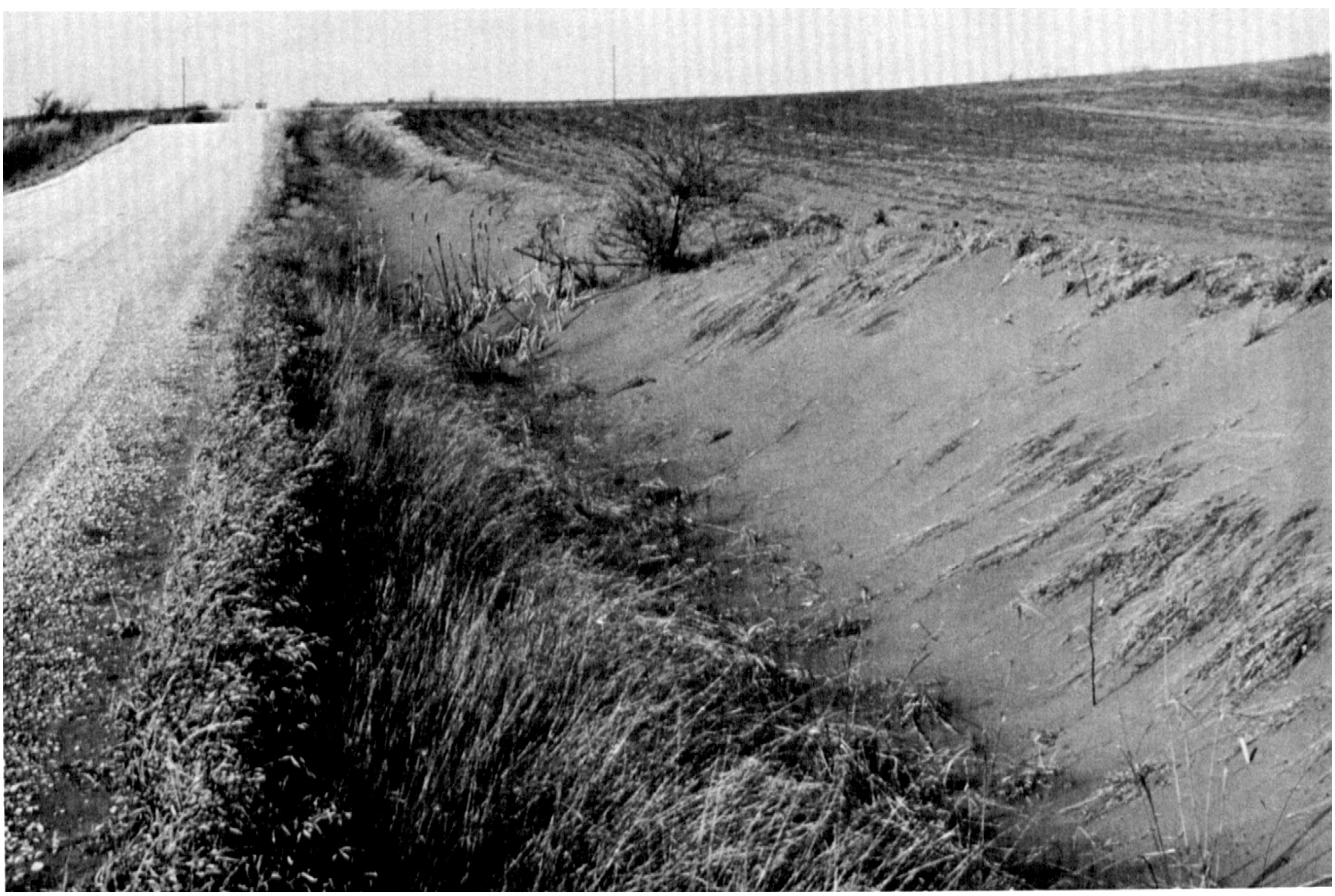

Figure 17.—In areas of the Dickinson-Sparta association, road ditches commonly are filled with sandy soil blown from adjoining fields. The filled ditches lose capacity to carry runoff.

Soil drainage is a management problem in some areas. Some soils are naturally wet and poorly drained, such as Clyde, Garwin, Maxfield, and Tripoli soils on the uplands. The Coland and Marshan soils on stream benches and bottom lands are poorly drained. Most poorly drained and somewhat poorly drained soils are more productive if tile drained. The somewhat poorly drained soils, such as Floyd, Klinger, Lawler, Muscatine, Protivin, and Readlyn soils, benefit from tile drainage in most years. If drained, field operations are less likely to be delayed by wetness, a better air to soil ratio is maintained, and root growth is improved.

Generally, soils in Butler County are naturally acid. They require applications of ground limestone to raise the pH level for optimum growth of crops, such as alfalfa, that grow well only on nearly neutral soils. Soils classed as poorly drained generally do not require addition of lime because they are approximately neutral in reaction. The Calco and Du Page soils, which are limited in extent in the county, are calcareous. Care needs to be taken if agricultural chemicals are applied to these soils.

The available potash level is naturally low or very low in the subsoil of all soils in Butler County. Available phosphorus is medium in the subsoil of Colo, Downs, Lamont, and Mt. Carroll soils and low or predominantly very low in the subsoil of most other soils.

Additions of lime and fertilizer should be based on results of soils tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is important in the germination of seeds and in the infiltration of water into the soil. Soil that has good tilth is generally high in organic matter and is porous.

Most of the soils used for crops have a loam surface layer; however, the soils in cropland vary from sandy loam, such as Lamont soils, to clay loam, such as Marshan soils. Organic matter content of the surface layer ranges from less than 1 percent in Chelsea and Lamont soils to more than 25 percent in Palms soils. The predominant percentage of organic matter in soils in cropland is 3 to 8 percent.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, sugar cane, canning peas, canning beans, and navy beans can be grown if economic conditions are favorable. Alfalfa and brome produce very well as a forage crop along with red clover and orchardgrass. Oats is the most common close-growing crop. Rye, barley, buckwheat, wheat, and flax can also be grown.

Specialty crops presently grown commercially in the survey area include sweet corn, canning beans, navy beans, and corn for hominy. The well drained soils are well suited to orchards and nursery crops.

Information and suggestions for growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs (*13*).

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. There are no Class VIII soils in Butler County.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is

the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, reduce energy requirements, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the

surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field (fig. 18), if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

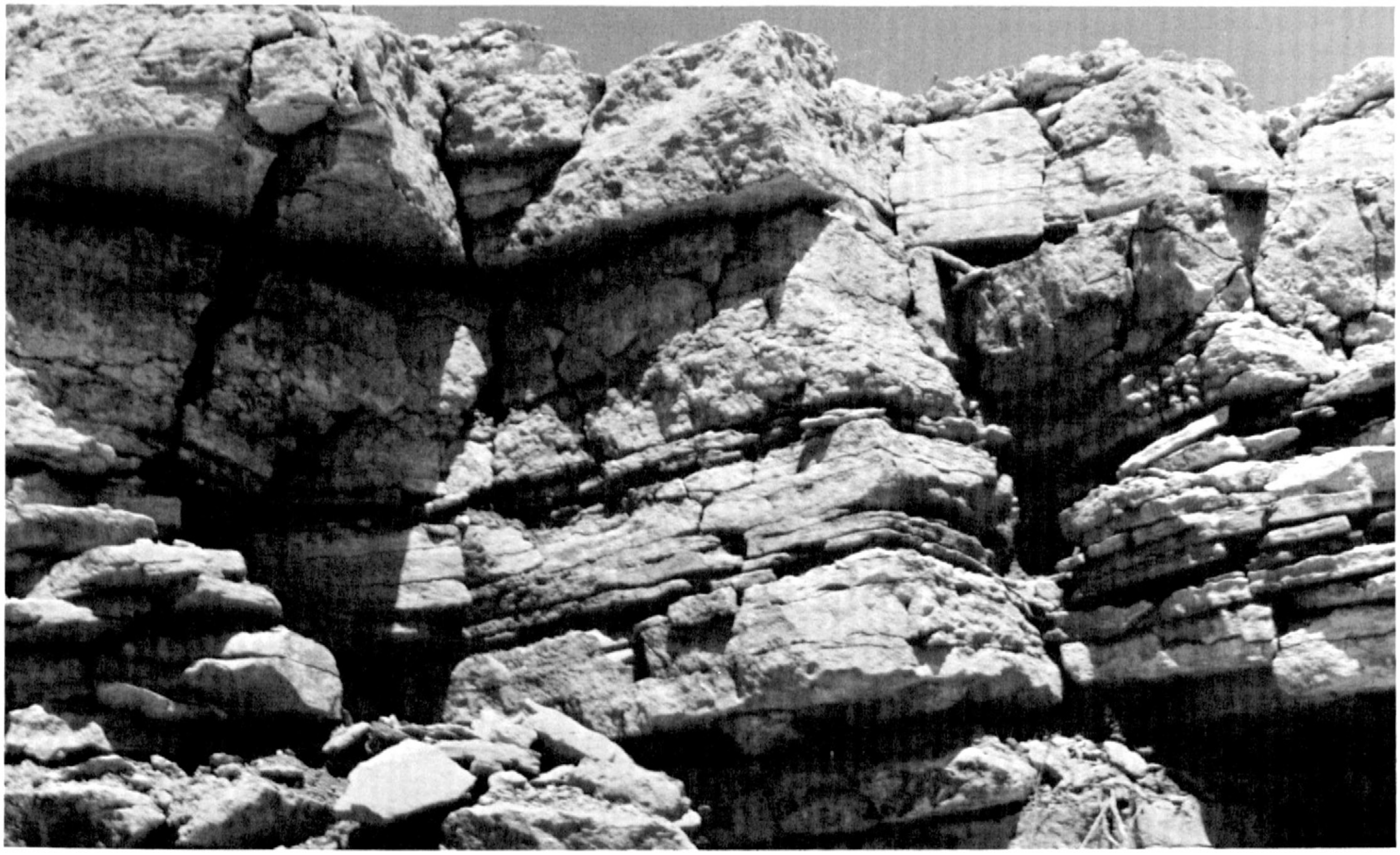

Figure 18.—Hard, level-bedded, limestone bedrock directly underlies the Backbone, Rockton, Sogn, and Winneshiek soils. Liquid entering the bedrock from sewage lagoons or other sanitary facilities is quite apt to pollute the ground water.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this

table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage

potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as high content of calcium carbonate. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and by soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments more than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*14*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*12*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*14*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Ackmore series

The Ackmore series consists of poorly drained, moderately permeable soils on narrow flood plains and alluvial fans. These soils formed in 20 to 36 inches of recently deposited silty alluvium overlying an older silty soil. Native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Ackmore soils are commonly adjacent to Colo and Ely soils. Colo and Ely soils have more organic matter and higher content of clay to a depth of 2 or 3 feet than Ackmore soils. Also, Ely soils are better drained and are

above the flood plain. Colo soils are on landscape positions similar to those occupied by Ackmore soils.

Typical pedon of Ackmore silt loam, 1 to 3 percent slopes, in a cultivated field; 1,940 feet east and 1,260 feet south of the northwest corner of sec. 30, T. 90 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; a little mixing of brown (10YR 5/3); weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

C1—8 to 27 inches; thinly stratified very dark gray (10YR 3/1) and grayish brown (10YR 5/2) silt loam; few fine distinct dark reddish brown (5YR 3/4) and yellowish red (5YR 5/6) mottles; weak thin platy structure; friable; neutral; clear smooth boundary.

C2—27 to 33 inches; stratified black (10YR 2/1) and grayish brown (10YR 5/2) silt loam; few red (2.5YR 4/8) iron oxide concretions; moderate thin platy structure; friable; neutral; clear smooth boundary.

IIA11b—33 to 43 inches; black (N 2/0) silty clay loam; moderate medium subangular blocky structure parting to moderate fine granular; neutral; gradual smooth boundary.

IIA12b—43 to 76 inches; black (10YR 2/1) silty clay loam; weak fine prismatic structure parting to moderate medium subangular; firm; neutral.

The A and C horizons range from 20 to 36 inches in thickness.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). In uncultivated areas, the A horizon has thin, black (10YR 2/1) to grayish brown (10YR 5/2) strata. The C horizon typically is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and has thin strata of higher value.

The A and C horizons are mainly silt loam but in places have thin strata of very fine sandy loam. The IIAb horizon typically is silty clay loam but ranges to silt loam in some pedons.

The A, C, and IIAb horizons are neutral or slightly acid.

Backbone series

The Backbone series consists of somewhat excessively drained soils on ridge crests and side slopes on uplands. These soils formed in about 20 to 40 inches of loamy material and a thin layer of clayey residuum. Underlying this is limestone bedrock. Permeability is moderately rapid. Native vegetation was prairie grasses and trees. Slope ranges from 2 to 9 percent.

Backbone soils are similar to Lamont soils and are commonly adjacent to Chelsea and Lamont soils in the landscape. Chelsea soils are sandy throughout. Lamont soils are not underlain by limestone bedrock. Both soils are on landscape positions similar to those of Backbone soils.

Typical pedon of Backbone fine sandy loam, 2 to 9 percent slopes, in a timbered pasture; 2,576 feet east and 2,370 feet south of the northwest corner of sec. 21, T. 92 N., R. 15 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; neutral; clear wavy boundary.

A2—6 to 10 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; a little mixing of very dark grayish brown (10YR 3/2); weak medium platy structure; very friable; slightly acid; clear wavy boundary.

B1—10 to 17 inches; brown (10YR 4/3) sandy loam; few small inclusions of very dark grayish brown (10YR 3/2); very weak medium subangular blocky structure; very friable; neutral; gradual smooth boundary.

B21t—17 to 23 inches; dark yellowish brown (10YR 4/4) sandy loam; few brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; very friable; sand grains are coated and bridged with clay; neutral; gradual smooth boundary.

B22t—23 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; few brown (10YR 4/3) coatings on faces of peds; few dark brown (10YR 3/3) clay films on faces of peds; weak fine subangular blocky structure; very friable; sand grains are bridged and coated with clay; neutral; gradual smooth boundary.

B23t—28 to 33 inches; yellowish brown (10YR 5/4) sandy clay loam; common dark brown (10YR 3/3) clay films on faces of peds; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

IIB24t—33 to 37 inches; brownish yellow (10YR 6/8) clay; nearly continuous dark grayish brown (10YR 4/2) clay films on faces of peds; thick very dark gray (10YR 3/1) clay films in pores and root channels; moderate fine subangular blocky structure; firm; neutral; abrupt wavy boundary.

IIR—37 inches; hard shattered limestone overlying hard fractured limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches.

The A1 or Ap horizon is commonly very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). In uncultivated areas, the A2 horizon is 2 to 4 inches thick. The B horizon is commonly brown (10YR 4/3) and dark yellowish brown (10YR 4/4 or 3/4) but ranges to dark brown (10YR 3/3) in the upper part and to yellowish brown (10YR 5/4) in the lower part. Some pedons have these same values and chromas in hue of 7.5YR. The

IIB horizon ranges from brown (7.5YR 4/4) to brownish yellow (10YR 6/8).

Typically, the A and B horizons are sandy loam or fine sandy loam. They range to loam or sandy clay loam in subhorizons less than 6 inches thick in the lower part of the B horizon. The IIB horizon ranges from clay loam to clay.

The A and B horizons are neutral or slightly acid and the IIB horizon is neutral to mildly alkaline.

The shattered upper part of the limestone bedrock ranges from 2 to 5 feet thick and contains 5 to 10 percent loamy materials. In some places, bits of clayey residuum are on the slabs of limestone. As slope increases, the thickness of the shattered limestone generally decreases.

Bassett series

The Bassett series consists of moderately well drained, moderately permeable soils on ridge crests and side slopes on uplands. These soils formed in about 13 to 24 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses and trees. Slope ranges from 0 to 25 percent.

Bassett soils are commonly adjacent to the Clyde, Donnan, Floyd, Kenyon, and Waubeek soils. Clyde and Floyd soils have a grayer subsoil than the Bassett soils and are not so well drained. Donnan soils have a higher clay content in the B horizon and are on side slopes below Bassett soils. Kenyon soils have a thicker, darker colored A horizon. Waubeek soils have less sand in the A horizon and upper part of the B horizon. Clyde and Floyd soils are along drainageways below Bassett soils. Kenyon and Waubeek soils are on landscape positions similar to those of the Bassett soils.

Typical pedon of Bassett loam, 2 to 5 percent slopes, in a cultivated field; 1,320 feet west and 1,403 feet south of the northeast corner of sec. 25, T. 92 N., R. 16 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; slightly acid; clear smooth boundary.

B1—9 to 17 inches; brown (10YR 4/3) clay loam; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; very strongly acid; clear smooth boundary.

IIB21t—17 to 25 inches; yellowish brown (10YR 5/6) loam; few brown (10YR 5/3) coatings on faces of prisms and peds; weak fine prismatic structure parting to weak medium subangular blocky; friable; few very dark grayish brown (10YR 3/2) clay films in pores and root channels; pebble band at top of horizon; few small pebbles throughout; very strongly acid; gradual smooth boundary.

IIB22t—25 to 34 inches; yellowish brown (10YR 5/6) loam; brown (10YR 5/3) coatings on faces of prisms and peds; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few thin discontinuous dark brown (10YR 3/3) clay films on prisms and peds and in pores and root channels; few small pebbles; strongly acid; gradual smooth boundary.

IIB3t—34 to 46 inches; yellowish brown (10YR 5/6) loam; few fine distinct dark grayish brown (10YR 4/2) mottles; weak medium prismatic structure; firm; thick very dark gray (10YR 3/2) clay films in pores and root channels; few pebbles; medium acid; clear wavy boundary.

IIC—46 to 60 inches; yellowish brown (10YR 5/6) loam; few medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; common soft lime accumulations; few pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 40 to 60 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3). It is 6 to 10 inches thick. Some pedons have an A2 horizon 2 to 6 inches thick. The IIB horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) and has mottles of 2 chroma below a depth of about 20 to 36 inches.

The A horizon is loam, and the B1 horizon is loam or clay loam. The IIB horizon mainly is loam but ranges to clay loam and sandy clay loam.

The A1 or Ap horizon ranges from neutral to medium acid. The A2, B1, and IIB2 horizons are strongly acid or very strongly acid, and the IIB3 horizon is slightly acid or medium acid. The IIC horizon is neutral or mildly alkaline.

Bolan series

The Bolan series consists of well drained soils on uplands and stream benches. These soils formed in loamy and sandy eolian materials and in alluvial sediment. Permeability is moderate in the upper part of the profile and rapid in the lower part. Native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Bolan soils are similar to Saude soils and are commonly adjacent to Dickinson soils. Saude soils are 20 to 30 inches deep over sandy material. Dickinson soils have sandy loam texture in the A horizon and upper part of the B horizon. Dickinson and Saude soils are on landscape positions similar to those of the Bolan soils.

Typical pedon of Bolan loam, 2 to 5 percent slopes, in a cultivated field; 2,495 feet south and 67 feet east of the center of sec. 13, T. 93 N., R. 16 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—9 to 17 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

B21—17 to 27 inches; dark yellowish brown (10YR 4/4) loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

B22—27 to 34 inches; yellowish brown (10YR 5/6) loam; few dark yellowish brown (10YR 4/4) coatings on faces of peds; weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

B3—34 to 52 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak coarse subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

C—52 to 80 inches; yellowish brown (10YR 5/4) loamy fine sand; massive; loose; slightly acid.

The thickness of the solum ranges from 30 to 56 inches. Typically, pebbles are absent to a depth of 5 feet or more. Thickness of the mollic epipedon ranges from 12 to 24 inches. Depth to sand or loamy sand ranges from 30 to 55 inches.

The A1 horizon is 7 to 15 inches thick. In some pedons, the mollic epipedon extends into the upper part of the B horizon. The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6) and commonly has a few darker coatings on the peds. The A1 horizon typically is loam but ranges to silt loam high in content of sand.

The B1 and B2 horizons are loam, and the B3 horizon is fine sandy loam or loamy fine sand. The C horizon ranges from loamy fine sand to medium sand.

The A horizon is neutral or slightly acid, and the B and C horizons are slightly acid or medium acid.

In map unit 174C2, the dark surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Bremer series

The Bremer series consists of poorly drained soils on low stream benches and drainageways extending into the uplands. These soils formed in silty sediment. Permeability is moderately slow. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

The Bremer soils in Butler County differ from Bremer soils in other areas in that they typically do not have the increase in clay necessary for an argillic horizon and are somewhat less acid than defined for the series. This difference does not alter the use or behavior of these soils.

Bremer soils are commonly adjacent to Nevin and Raddle soils. Nevin and Raddle soils have a browner B horizon than Bremer soils and are better drained. They are at a slightly higher elevation than Bremer soils.

Typical pedon of Bremer silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,720 feet south and 520 feet east of the northwest corner of sec. 25, T. 90 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; neutral; clear smooth boundary.

A12—8 to 21 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

B1g—21 to 27 inches; very dark gray (5Y 3/1) silty clay loam; discontinuous very dark gray (10YR 3/1) coatings on faces of peds; few fine distinct dark brown (7.5YR 4/4) mottles; strong very fine subangular blocky structure; friable; neutral; clear wavy boundary.

B2g—27 to 35 inches; olive gray (5Y 5/2) silty clay loam; few very dark gray (10YR 3/1) coatings on faces of prisms and peds; weak fine prismatic structure parting to moderate fine and very fine subangular blocky; friable; few strong brown (7.5YR 5/8) iron oxide concretions; neutral; gradual smooth boundary.

B3g—35 to 44 inches; olive gray (5Y 5/2) silty clay loam; weak medium subangular blocky structure; friable; few strong brown (7.5YR 5/8) iron oxide concretions; neutral; gradual smooth boundary.

C1g—44 to 53 inches; light olive gray (5Y 6/2) and gray (5Y 5/1) silty clay loam; common strong brown (7.5YR 5/8) iron oxide concretions; massive; friable; mildly alkaline; gradual smooth boundary.

C2g—53 to 64 inches; gray (5Y 5/1) silt loam; common strong brown (7.5YR 5/8) iron oxide concretions; massive; friable; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 24 to 36 inches.

The A horizon is black (N 2/0 or 10YR 2/1) silty clay loam. The B1g horizon is very dark gray (N 2/0, 10YR 2/1, 5Y 2/1, or 5Y 3/1). The B horizon is silty clay loam. The lower part of the B horizon ranges from dark gray (5Y 4/1) to olive (5Y 4/3 or 5/3) and in some pedons has gray mottles.

The A and B horizons are neutral or slightly acid. The C horizon ranges from mildly alkaline to slightly acid.

Burkhardt series

The Burkhardt series consists of excessively drained soils on stream benches, bench escarpments, and uplands. These soils formed in 10 to 20 inches of sandy loam containing some gravel and overlie sand and gravel. Permeability is moderately rapid in the solum and very rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 2 to 18 percent.

Burkhardt soils are commonly adjacent to Flagler, Olin, and Saude soils. Burkhardt soils are shallower to loamy sand or sand than Flagler and Saude soils. They have a coarser textured substratum than Olin soils. Flagler and Saude soils are on landscape positions similar to those of Burkhardt soils. Olin soils are upslope at a higher elevation than Burkhardt soils.

Typical pedon of Burkhardt sandy loam, 2 to 9 percent slopes, in an uncultivated field; 2,400 feet west and 15 feet south of the northeast corner of sec. 19, T. 92 N., R. 15 W.

A1—0 to 9 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak very coarse granular structure parting to weak very fine granular; very friable; few pebbles; slightly acid; clear wavy boundary.

A3—9 to 12 inches; dark brown (10YR 3/3) sandy loam; brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak coarse granular structure parting to weak very fine granular; very friable; few small pebbles; slightly acid; clear smooth boundary.

IIB2—12 to 17 inches; brown (10YR 4/3) fine gravelly sandy loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; loose; about 30 percent fine gravel; slightly acid; clear smooth boundary.

IIC1—17 to 27 inches; brown (10YR 4/3) gravelly loamy sand; single grain; loose; about 40 percent gravel; medium acid; clear smooth boundary.

IIC2—27 to 45 inches; dark yellowish brown (10YR 3/4) loamy coarse sand; single grain; loose; few pebbles; slightly acid; clear smooth boundary.

IIC3—45 to 52 inches; brown (10YR 5/3) fine sand; single grain; loose; few small pebbles; neutral; clear smooth boundary.

IIC4—52 to 64 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 25 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 20 inches and in many places is the same as the depth to sandy material. Thickness of the mollic epipedon ranges from 10 to 15 inches.

The A horizon is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3). The B horizon ranges from dark brown (10YR 3/3) to strong brown (7.5YR 5/6). The IIC horizon ranges from brown (10YR 5/3) to strong brown (7.5YR 5/6).

The B horizon ranges from sandy loam with a few pebbles to gravelly sand. The IIC horizon ranges from loamy sand with a few pebbles to gravelly sand.

The reaction ranges from slightly acid to strongly acid in the solum to a depth of about 48 inches in the substratum. Below this, it ranges from medium acid to mildly alkaline.

In map units 241C2 and 241E2, the dark surface layer is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of these soils.

Calco series

The Calco series consists of poorly drained, moderately permeable soils on bottom lands. These soils formed in calcareous, silty alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Calco soils are similar to Coland soils and are commonly adjacent to Coland and Colo soils. Coland and Colo soils are not calcareous and are on landscape positions similar to those of Calco soils.

Typical pedon of Calco silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,345 feet north and 1,220 feet west of the southeast corner of sec. 5, T. 90 N., R. 17 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 19 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A13—19 to 32 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; weak effervescence; mildly alkaline; gradual smooth boundary.

Bg—32 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few black (10YR 2/1) manganese oxide concretions; friable; mildly alkaline; gradual smooth boundary.

C1—41 to 51 inches; strong brown (7.5YR 5/6) silty clay loam; common medium prominent grayish brown (2.5Y 5/2) mottles; massive; friable; mildly alkaline; gradual smooth boundary.

C2g—51 to 60 inches; mottled dark grayish brown (2.5Y 4/2), dark gray (5Y 4/1), and strong brown (7.5YR 5/6) fine sandy loam; massive; very friable; mildly alkaline.

The thickness of the solum ranges from 36 to 50 inches. Thickness of the mollic epipedon ranges from 30 to 45 inches.

The A horizon typically is black (N 2/0 or 10YR 2/1) but ranges to very dark gray (10YR 3/1 or 5Y 2/1) in the lower part. It is silty clay loam but ranges to silt loam in the upper 10 inches. The Bg horizon ranges from very dark gray (N 3/0) to grayish brown (2.5Y 5/2). It is 0 to 10 inches thick. The soil is mildly alkaline or moderately alkaline throughout.

Chelsea series

The Chelsea series consists of excessively drained, rapidly permeable soils on uplands. These soils formed in eolian sand. Native vegetation was trees. Slope ranges from 2 to 9 percent.

Chelsea soils are commonly adjacent to Backbone and Sparta soils. Backbone soils are underlain by limestone bedrock. Sparta soils have a mollic epipedon. Backbone and Sparta soils are on slightly lower landscape positions than the Chelsea soils.

Typical pedon of Chelsea loamy fine sand, 2 to 9 percent slopes, in a cultivated field; 2,580 feet west and 940 feet north of the southeast corner of sec. 16, T. 92 N., R. 15 W.

Ap—0 to 8 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; neutral; clear smooth boundary.

A2—8 to 33 inches; dark yellowish brown (10YR 4/4) loamy fine sand, pale brown (10YR 6/4) dry; single grain; loose; medium acid; clear smooth boundary.

A&B—33 to 70 inches; brown (10YR 5/3) loamy fine sand (A2); single grain; loose; few lamellae and bands of dark yellowish brown (10YR 3/4) loamy fine sand (B2); very friable; total thickness of bands is less than 6 inches; medium acid.

The thickness of the solum ranges from 36 inches to many feet.

The Ap horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), or dark brown (10YR 3/3). In uncultivated and uneroded sites, the A1 horizon is 2 to 5 inches thick. It is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). Some pedons have a brown (10YR 4/3) to light yellowish brown (10YR 6/4) A2 horizon 6 to 30 inches thick. The B horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6) and is lamellae within the C horizon. The total thickness of the lamellae in the part of the soil above 60 inches is less than 6 inches.

The A and C horizons are fine sand or loamy fine sand. The B2 lamellae are loamy fine sand or fine sandy loam.

The Ap horizon ranges from neutral to medium acid, and below this the soil is medium acid or strongly acid.

Clyde series

The Clyde series consists of poorly drained, moderately permeable soils in drainageways on the lower part of concave slopes and at the head of drainageways on uplands. These soils formed in about 40 to 60 inches of loamy sediment underlying loamy glacial till. In some pedons, the solum extends into the underlying glacial till. Native vegetation was prairie grasses. Slope typically ranges from 0 to 4 percent.

Clyde soils are similar to Floyd and Tripoli soils and are commonly adjacent to Bassett, Floyd, Kenyon, and Schley soils. Floyd, Bassett, and Kenyon soils are not so poorly drained and have a browner B horizon than the Clyde soils. Tripoli soils are less stratified and shallower to till. Schley soils have a thinner, dark colored surface horizon and are better drained. Bassett, Floyd, Kenyon, and Schley soils are on higher landscape positions adjacent to Clyde soils along the drainageways.

Typical pedon of Clyde silty clay loam, 0 to 3 percent slopes, in a cultivated field; 780 feet south and 105 feet west of the northeast corner of sec. 29, T. 93 N., R. 15 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam high in content of sand, very dark gray (N 3/0) dry; weak coarse subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

A12—8 to 18 inches; black (N 2/0) silty clay loam high in content of sand, very dark gray (N 3/0) dry; weak medium subangular blocky structure parting to moderate fine granular structure; friable; neutral; clear wavy boundary.

A3g—18 to 22 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B1g—22 to 27 inches; dark grayish brown (2.5Y 4/2) clay loam; many fine distinct light olive brown (2.5Y 5/4) and olive (5Y 5/3) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B2—27 to 33 inches; light olive brown (2.5Y 5/6) loam; common fine distinct grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; few strong brown (7.5YR 5/6) iron oxide concretions; neutral; clear smooth boundary.

B3—33 to 42 inches; yellowish brown (10YR 5/8) sandy loam; common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; very friable; pebble band in upper 3 inches; few pebbles throughout; neutral; gradual smooth boundary.

IIC1—42 to 53 inches; stratified yellowish brown (10YR 5/6) sandy clay loam and gray (5Y 6/1) loam; few fine distinct gray (5Y 6/1) mottles; massive; friable; neutral; gradual smooth boundary.

IIC2—53 to 62 inches; pale brown (10YR 6/3) loamy sand; few fine distinct light olive brown (2.5Y 5/6) mottles; single grain; loose; few very small pebbles; neutral; clear smooth boundary.

IIIC3—62 to 72 inches; strong brown (7.5YR 5/6) loam; common medium distinct light gray (5Y 6/1) mottles; massive; firm; few small pebbles; neutral.

The thickness of the solum ranges from 40 to 60 inches, and the depth to carbonates ranges from 45 to 80 inches. Thickness of the mollic epipedon ranges from 18 to 24 inches.

The Ap or A1 horizon is black (N 2/0), and the A3 horizon is very dark gray (10YR 3/1). Typically, the A horizon is silty clay loam high in sand but ranges from silt loam to clay loam. The B horizon ranges from gray (10YR 4/1) to light olive gray (5Y 6/2) and light olive brown (2.5Y 5/6). The B horizon is mainly loam or clay loam but includes subhorizons of silty clay loam, sandy loam, and sandy clay loam. The IIB and IIC horizons have hue of 7.5YR through 5Y, value of 4, 5, or 6, and chroma of 1 through 6. They range from loamy sand to clay loam. The solum is neutral, and the IIC horizon is neutral or mildly alkaline.

Coland series

The Coland series consists of poorly drained, moderately permeable soils on bottom lands and in drainageways on uplands. These soils formed in loamy alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 4 percent in most places.

The Coland soils are similar to Calco, Colo, and Shandep soils and are commonly adjacent to the Calco, Spillville, and Terril soils. Calco soils are calcareous. Colo soils contain less sand than Coland soils. Shandep soils have more sand in the lower part of the solum. Spillville soils contain more clay and are less poorly drained than Coland soils. Terril soils have a browner B horizon and are better drained. Calco soils are on landscape positions similar to those of Coland soils. Spillville soils are on slightly higher lying positions. Terril soils are on foot slopes above Coland soils.

Typical pedon of Coland clay loam, 0 to 2 percent slopes, in a pasture; 160 feet north and 63 feet east of the southwest corner of sec. 19, T. 92 N., R. 18 W.

A11—0 to 7 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate coarse granular structure; friable; neutral; clear smooth boundary.

A12—7 to 20 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A13—20 to 31 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; moderate medium granular structure; friable; neutral; clear smooth boundary.

A14—31 to 39 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; neutral; gradual smooth boundary.

AC—39 to 45 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds in the upper part; weak medium prismatic structure; firm; neutral; gradual smooth boundary.

Cg—45 to 66 inches; stratified very dark gray (10YR 3/1) sandy clay loam and sandy loam; common fine distinct dark brown (7.5YR 4/4) mottles; massive; friable; neutral.

The thickness of the solum ranges from 36 to 48 inches. Thickness of the mollic epipedon ranges from 36 to 60 inches or more.

The A horizon typically is black (N 2/0 or 10YR 2/1) but ranges to very dark gray (10YR 3/1 or 5Y 3/1) in the lower part. It is clay loam or silty clay loam high in sand but ranges to loam in the upper 10 inches. The C horizon ranges from sandy loam to clay loam. The soil is neutral or slightly acid throughout.

Colo series

The Colo series consists of poorly drained, moderately permeable soils on bottom lands and in drainageways on uplands. These soils formed in silty alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Colo soils are similar to Coland soils and are commonly adjacent to Ackmore, Calco, and Ely soils. Coland soils have more sand throughout the solum than Colo soils and have sandy stratified materials in the subsoil. Ackmore soils formed in lighter colored sediment. Calco soils are calcareous. Ely soils have a browner B horizon and have better internal drainage. Ackmore and Calco soils are on landscape positions similar to those of Colo soils. Ely soils are upslope from Colo soils.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,570 feet south and 113 feet east of the northwest corner of sec. 14, T. 90 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak medium granular structure; friable; neutral; clear smooth boundary.

A12—8 to 22 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A13g—22 to 51 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; common medium distinct olive brown (2.5Y 4/4) mottles; weak coarse subangular blocky structure; friable; neutral; gradual smooth boundary.

C1g—51 to 60 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) and few fine distinct olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; friable; few small dark reddish brown (5YR 2/2) manganese oxide concretions; neutral; gradual smooth boundary.

C2g—60 to 72 inches; light olive gray (5Y 6/2) silt loam; common fine distinct reddish yellow (7.5Y 6/8) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 54 inches. Thickness of the mollic epipedon ranges from 36 to 60 inches or more.

The A horizon typically is black (N 2/0 or 10YR 2/1) but ranges to very dark gray (10YR 3/1 or 5Y 3/1) in the lower part. It is silty clay loam but ranges to silt loam in the upper 10 inches. The A horizon is neutral or slightly acid.

Cresco series

The Cresco series consists of moderately well drained soils on ridge crests and upper side slopes on uplands. These soils formed in 13 to 22 inches of loamy sediment and the underlying glacial till. Permeability is moderately slow. Native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Cresco soils are commonly adjacent to Kenyon and Protivin soils. Kenyon soils contain less clay in the IIB horizon than Cresco soils. Kenyon soils are on landscape positions similar to those of Cresco soils. Protivin soils are more poorly drained and have a grayer subsoil than Cresco soils. Protivin soils are downslope from Cresco soils.

Typical pedon of Cresco loam, 2 to 5 percent slopes, in a cultivated area; 780 feet east and 50 feet south of the northwest corner of sec. 21, T. 93 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) discontinuous coatings on faces of peds; weak fine granular structure; friable; medium acid; clear smooth boundary.

IIB1—13 to 19 inches; brown (10YR 4/3) clay loam, discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; root channels lined with very dark brown (10YR 2/2); 3-inch pebble band in upper part of horizon; few small pebbles throughout; strongly acid; gradual smooth boundary.

IIB21t—19 to 23 inches; yellowish brown (10YR 5/4) clay loam; brown (10YR 4/3) coatings on faces of prisms and peds; weak fine prismatic structure parting to moderate fine subangular blocky; friable; thin discontinuous dark brown (10YR 3/3) clay films; few small pebbles; strongly acid; clear smooth boundary.

IIB22t—23 to 29 inches; yellowish brown (10YR 5/6) clay loam; nearly continuous dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) coatings on faces of prisms and peds; weak fine prismatic structure parting to moderate fine subangular blocky; firm; thin discontinuous dark brown (10YR 3/3) clay films on peds and in pores and root channels; strongly acid; clear wavy boundary.

IIB23t—29 to 43 inches; yellowish brown (10YR 5/6) clay loam; nearly continuous gray (5Y 5/1) coatings on faces of prisms and peds; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous dark grayish brown (2.5Y 4/2) clay films on prisms and peds and in pores and root channels; few small pebbles; slightly acid; clear wavy boundary.

IIB3—43 to 47 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct gray (5Y 5/1) mottles; weak medium prismatic structure; very firm; few small pebbles; mildly alkaline; clear wavy boundary.

IIC—47 to 72 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct gray (5Y 6/1) mottles; massive; very firm; few dark reddish brown (5YR 2/2) manganese oxide concretions; few lime concretions; strong effervescence; moderately alkaline.

The thickness of the solum is commonly the same as the depth to carbonates and typically ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 10 to 16 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). Some pedons do not have an A3 horizon, and some pedons have a B1 horizon. The coatings on the prisms and peds in the upper part of the IIB2 horizon range from brown (10YR 4/3) and dark grayish brown (2.5Y 4/2) to gray (5Y 6/1). Depth to gray (5Y 5/1 or 6/1) coatings ranges from 14 to 26 inches.

The A and B1 horizons typically are loam but in some pedons are clay loam. The average clay content of the IIB horizon ranges from 30 to 35 percent, but the

subhorizons in some pedons are as much as 37 percent clay.

The A horizon is neutral to medium acid. The upper part of the IIB2 horizon is strongly acid. The IIB3 horizon is slightly acid to mildly alkaline. The IIC horizon is mildly alkaline.

In map unit 783C2, the dark surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Dickinson series

The Dickinson series consists of well drained and somewhat excessively drained soils on uplands and stream benches. These soils formed in sandy loam eolian and alluvial sediment. Permeability is moderately rapid in the solum and rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Dickinson soils are similar to Sparta soils and are commonly adjacent to Bolan, Hoopeston, Olin, and Sparta soils. Sparta soils have more sand in the A and B horizons than Dickinson soils, and Bolan soils have less sand. Hoopeston soils have a grayer B horizon and are not so well drained. Olin soils formed in glacial till. These soils are on landscape positions similar to those of Dickinson soils.

Typical pedon of Dickinson fine sandy loam, 2 to 5 percent slopes, in a cultivated field; 1,850 feet north and 1,040 feet east of the southwest corner of sec. 5, T. 92 N., R. 15 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; neutral; clear smooth boundary.

A3—9 to 15 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; neutral; gradual smooth boundary.

B2—15 to 24 inches; dark yellowish brown (10YR 4/4) fine sandy loam; dark brown (10YR 3/3) coatings on faces of peds; very weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

C1—24 to 41 inches; dark yellowish brown (10YR 4/4) loamy sand; single grain; loose; slightly acid; gradual smooth boundary.

C2—41 to 72 inches; brown (10YR 4/3) loamy sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 24 to 50 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches. Depth to loamy sand or sand ranges from 20 to 40 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6) and commonly has a few darker coatings on the peds.

The A horizon typically is fine sandy loam but ranges to sandy loam, and in some pedons this horizon is loam 8 to 12 inches thick. The B horizon typically is fine sandy loam. Some pedons have a B3 horizon ranging from loamy fine sand to sand. The C horizon ranges from loamy fine sand to sand.

The A horizon is neutral or slightly acid, and the B and C horizons are slightly acid or medium acid.

Dinsdale series

The Dinsdale series consists of well drained, moderately permeable soils on ridge crests and side slopes on uplands. These soils formed in about 24 to 40 inches of loess and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Dinsdale soils are commonly adjacent to Donnan, Ely, Kenyon, and Klinger soils. Donnan soils have a higher clay content in the B horizon than Dinsdale soils. Ely soils have a thicker A horizon and a grayer B horizon. Kenyon soils are higher in sand in the upper part and are shallower to glacial till than Dinsdale soils. Klinger soils have a grayer B horizon and are more poorly drained. Donnan, Ely, and Kenyon soils are downslope from Dinsdale soils. Klinger soils are in less sloping areas.

Typical pedon of Dinsdale silty clay loam, 2 to 5 percent slopes, in a cultivated field; 2,598 feet west and 335 feet north of the southeast corner of sec. 16, T. 90 N., R. 18 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—8 to 14 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; medium acid; clear wavy boundary.

B1—14 to 19 inches; brown (10YR 4/3) silty clay loam; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear wavy boundary.

B2t—19 to 29 inches; brown (10YR 4/3) silty clay loam; dark brown (10YR 3/3) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) clay films on peds and in pores and root channels; medium acid; clear smooth boundary.

IIB31t—29 to 39 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; very friable; clay bridging between sand grains; pebble band in upper part of horizon; few small pebbles throughout horizon; medium acid; clear smooth boundary.

IIB32—39 to 52 inches; yellowish brown (10YR 5/4 and 5/8) loam; few fine distinct light brownish gray (2.5Y 6/2) mottles; moderate medium prismatic structure; friable; few light gray (10YR 7/2) fine sand grains on peds when dry; slightly acid; few small pebbles; clear wavy boundary.

IIC1—52 to 73 inches; yellowish brown (10YR 5/4) loam; few fine distinct strong brown (7.5YR 5/8) and gray (10YR 6/1) mottles; massive; firm; few small pebbles; slightly acid; clear wavy boundary.

Thickness of the solum ranges from 42 to 60 inches. Depth to carbonates ranges from 45 to 74 inches. Thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A horizon is 10 to 18 inches thick. The B1 horizon is brown (10YR 4/3) or dark brown (10YR 3/3). The B2 horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4). The IIB horizon ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/8). Mottles that have chroma of 2 are in some pedons below a depth of about 30 to 40 inches.

The IIB horizon typically is loam but ranges to sandy clay loam and clay loam. Sandy loam 0 to 10 inches thick is between the loess and the underlying glacial till.

The Ap horizon ranges from neutral to medium acid. The B2 horizon and the upper part of the IIB horizon are medium acid. The IIB3 horizon is slightly acid or medium acid. The IIC horizon ranges from slightly acid to mildly alkaline.

In map unit 377C2, the dark surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Donnan series

The Donnan series consists of somewhat poorly drained and moderately well drained soils on ridge crests and convex side slopes on uplands. These soils formed in about 20 to 40 inches of loamy sediment and in the underlying, very firm glacial till. Permeability is moderate in the upper part of the profile and very slow in the lower part. Native vegetation was trees. Slope ranges from 2 to 9 percent.

The Donnan soils commonly are adjacent to the Bassett, Dinsdale, and Kenyon soils. These soils are higher on the landscape than Donnan soils and contain less clay in the IIB horizon.

Typical pedon of Donnan loam, 2 to 5 percent slopes, in a cultivated field; 1,340 feet west and 120 feet south of the northeast corner of sec. 9, T. 92 N., R. 17 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine granular structure; friable; neutral; clear smooth boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure; friable; strongly acid; clear wavy boundary.

B1—12 to 19 inches; dark yellowish brown (10YR 4/4) clay loam; few brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

B21—19 to 27 inches; brown (10YR 5/3) clay loam; few fine faint dark brown (7.5YR 4/4) and grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; few very small pebbles; medium acid; clear smooth boundary.

IIB22t—27 to 35 inches; gray (5Y 5/1) clay; common fine distinct reddish brown (5YR 4/4) mottles; moderate fine angular blocky structure; very firm; thin discontinuous dark gray (5Y 4/1) clay films on peds; few white (10YR 8/2) very fine sand coatings on peds when dry; medium acid; gradual smooth boundary.

IIB23t—35 to 42 inches; dark gray (5Y 4/1) clay; common fine distinct reddish brown (5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous dark gray (5Y 4/1) clay films on prisms and peds; few white (10YR 8/2) fine sand coatings on prisms when dry; medium acid; gradual smooth boundary.

IIB3t—42 to 56 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine prismatic structure; very firm; thin discontinuous dark gray (10YR 4/1) clay films on prisms and in pores and root channels; few small pebbles; medium acid; gradual smooth boundary.

IIC—56 to 72 inches; light olive brown (2.5Y 5/4) loam; common fine distinct olive gray (5Y 5/2) and dark yellowish brown (10YR 4/4) mottles; massive; very firm; few small pebbles; slightly acid.

The thickness of the solum ranges from 40 to 70 inches. Depth to carbonates is generally more than 6 feet. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon is 2 to 5 inches thick. The A horizon typically is loam but ranges to silt loam high in sand.

The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4) and has few to common mottles with chroma of 2. The B horizon is dominantly loam, clay loam, and sandy clay loam but has subhorizons less than 6 inches thick of sandy loam and silty clay loam high in sand.

The IIB2 horizon ranges from dark gray (10YR 4/1) to light olive gray (5Y 6/2) and has few to many mottles that have high chroma. The IIB2 horizon is clay or silty clay. The IIB3 and IIC horizons range from dark gray (10YR 4/1) silty clay to mottled, yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam and clay loam. The Ap horizon ranges from neutral to medium acid. The B and IIB horizons are medium acid or strongly acid. The IIC horizon ranges from medium acid to mildly alkaline.

Downs series

The Downs series consists of well drained, moderately permeable soils on convex ridge crests and side slopes on uplands. These soils formed in loess. Native vegetation was prairie grasses and trees. Slope ranges from 5 to 9 percent.

Downs soils are similar to and are commonly adjacent to Mt. Carroll soils. Mt. Carroll soils have less clay in the B horizon than Downs soils. They are more sloping and are downslope from Downs soils.

Typical pedon of Downs silt loam, 5 to 9 percent slopes, in a cultivated field; 165 feet west and 105 feet north of the southeast corner of NE 1/4 sec. 19, T. 90 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—8 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; discontinuous dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to moderate fine subangular blocky; friable; medium acid; clear wavy boundary.

B21t—11 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; common dark brown (7.5YR 3/2) and very dark grayish brown (10YR 3/2) clay films on ped faces and in pores and root channels; medium acid; gradual smooth boundary.

B22t—22 to 36 inches; dark yellowish brown (10YR 4/4) silt loam; brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; friable; few dark brown (7.5YR 3/2) clay films on ped faces and in pores and root channels; medium acid; gradual smooth boundary.

B3—36 to 46 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; very pale brown (10YR 7/3) silt coatings on peds when dry; few small yellowish red (5YR 4/8) iron oxide concretions; medium acid; gradual smooth boundary.

C1—46 to 55 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct pale brown (10YR 6/3) mottles; massive; friable; few small yellowish red (5YR 4/8) iron oxide concretions; medium acid; gradual smooth boundary.

C2—55 to 64 inches; dark yellowish brown (10YR 4/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; few yellowish red (5YR 4/8) and dark reddish brown (5YR 2/2) iron and manganese oxide concretions; medium acid.

The thickness of the solum ranges from 42 to more than 60 inches. Depth to carbonates is more than 60 inches in most places. Thickness of material that has mollic colors ranges from 6 to 9 inches.

The Ap or A1 horizon ranges from very dark brown (10YR 2/2) or very dark gray (10YR 3/1) to dark brown (10YR 3/3). The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It ranges from 0 to 5 inches in thickness. The B horizon typically is dark yellowish brown (10YR 4/4) but ranges to brown (10YR 4/3) in the B1 horizon and to yellowish brown (10YR 5/4 or 5/6) in the B2 and B3 horizons.

The A horizon ranges from neutral to medium acid. The B horizon is commonly medium acid but ranges to strongly acid. The C horizon ranges from medium acid to mildly alkaline.

Du Page series

The Du Page series consists of moderately well drained, moderately permeable soils on bottom lands. These soils formed in loamy, calcareous alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Du Page soils are similar to and are commonly adjacent to Spillville soils. Spillville soils are not calcareous. They are slightly higher on the landscape than Du Page soils.

Typical pedon of Du Page loam, 0 to 2 percent slopes, in a cultivated area; 140 feet south and 40 feet west of the northeast corner of sec. 29, T. 93 N., R. 16 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine granular structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 36 inches; black (10YR 2/1) silt loam high in fine sand, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to weak medium granular; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A13—36 to 49 inches; black (10YR 2/1) silt loam high in sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak very fine granular; friable; strong effervescence; mildly alkaline.

A14—49 to 63 inches; very dark brown (10YR 2/2) heavy loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak medium subangular blocky structure parting to weak fine granular; friable; few small shell fragments and a few small shells; violent effervescence; moderately alkaline; gradual smooth boundary.

C—63 to 98 inches; dark gray (10YR 4/1) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few dark reddish brown (5YR 3/2) iron oxide concretions; few small shell fragments; violent effervescence; moderately alkaline.

The thickness of the solum typically is 50 to 70 inches but ranges from 40 to 80 inches.

The A horizon to a depth of 30 to 40 inches is black (10YR 2/1) or very dark brown (10YR 2/2). The lower part of the A horizon ranges from black (10YR 2/1) to very dark grayish brown (2.5Y 3/2) and dark brown (10YR 3/3). The C horizon has hue of 10YR and 2.5Y, value of 3 or 4, and chroma of 1 or 2.

The A horizon is loam or silt loam and has a noticeable amount of sand. The C horizon is loam or stratified loam and sandy loam.

The reaction is mildly alkaline or moderately alkaline throughout.

Ely series

The Ely series consists of somewhat poorly drained, moderately permeable soils on foot slopes and alluvial fans on uplands. These soils formed in silty, local alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Ely soils are similar to Muscatine and Worthen soils and are commonly adjacent to Ackmore, Colo, and Dinsdale soils. Muscatine soils have an A horizon less than 20 inches thick. Worthen soils are well drained and have less clay in the solum than Ely soils. Ackmore soils formed in lighter colored sediment. Colo soils have poorer drainage than Ely soils. Dinsdale soils have an A horizon less than 20 inches thick and have better internal drainage. Ackmore and Colo soils are downslope, and Dinsdale soils are upslope from Ely soils.

Typical pedon of Ely silt loam, 2 to 5 percent slopes, in a cultivated field; 2,495 feet east and 105 feet north of the southwest corner of sec. 1, T. 90 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure parting to moderate fine and very fine granular; friable; neutral; clear smooth boundary.

A12—8 to 21 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; discontinuous black (10YR 2/1) coatings on faces of peds; moderate medium subangular blocky structure parting to moderate fine and very fine subangular blocky; friable; slightly acid; gradual smooth boundary.

A3—21 to 29 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine subangular blocky structure parting to moderate fine granular; friable; slightly acid; clear wavy boundary.

B1—29 to 34 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine distinct dark grayish brown (2.5Y 4/2) mottles; moderate very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B2—34 to 41 inches; olive brown (2.5Y 4/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; few dark reddish brown (5YR 2/2) manganese oxide concretions; neutral; gradual smooth boundary.

B3—41 to 49 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few dark reddish brown (5YR 2/2) manganese oxide concretions; neutral; gradual smooth boundary.

C—49 to 74 inches; grayish brown (2.5Y 5/2) silt loam; few fine distinct olive mottles; massive; friable; few yellowish red (5YR 5/8) and dark reddish brown (5YR 2/2) iron and manganese oxide concretions; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 24 to 36 inches.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). In some areas that have recent overwash, the A1 or Ap horizon is dark brown (10YR 3/3). The B1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and has a few grayish mottles. The B2 and B3 horizons range from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2).

Typically, the upper part of the A horizon is silt loam, and the lower part is silt loam or silty clay loam.

The solum is slightly acid or neutral, and the C horizon is neutral or mildly alkaline.

Flagler series

The Flagler series consists of somewhat excessively drained soils on stream benches and in a few places on uplands. These soils formed in 20 to 40 inches of sandy loam overlying loamy sand or sand that contains some gravel. Permeability is moderately rapid in the solum and very rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Flagler soils are commonly adjacent to Burkhardt and Saude soils. Burkhardt soils have gravelly materials below a depth of 10 to 20 inches. Saude soils have less sand in the A and B horizons than Flagler soils. Both soils are on landscape positions similar to those of Flagler soils.

Typical pedon of Flagler sandy loam, 0 to 2 percent slopes, in a cultivated field; 1,395 feet north and 70 feet east of the southwest corner of sec. 35, T. 93 N., R. 16 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

A12—8 to 15 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; very friable; neutral; clear smooth boundary.

B1—15 to 19 inches; dark brown (10YR 3/3) sandy loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

B2—19 to 25 inches; brown (10YR 4/3) sandy loam; few dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

IIC—25 to 60 inches; dark yellowish brown (10YR 4/4) loamy sand; single grain; loose; about 10 percent gravel; slightly acid.

The thickness of the solum and depth to loamy sand or sand ranges from 20 to 36 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches.

The A horizon typically is very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) but ranges to black (10YR 2/1). The B1 horizon is dark brown (10YR 3/3) or brown (10YR 4/3). The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6).

The A horizon ranges from neutral to medium acid, and the B horizon ranges from slightly acid to strongly acid. The IIC horizon ranges from neutral to strongly acid.

Floyd series

The Floyd series consists of somewhat poorly drained, moderately permeable soils on slightly concave lower side slopes adjacent to drainageways in uplands. These soils formed in about 30 to 45 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

The Floyd soils are similar to Clyde soils and are commonly adjacent to Bassett, Clyde, Kenyon, and Ostrander soils. Clyde soils are grayer in the B horizon than Floyd soils and are more poorly drained. They are downslope from Floyd soils. Bassett and Kenyon soils are less stratified and are shallower to glacial till. Bassett, Kenyon, and Ostrander soils are better drained and are browner in the upper part of the B horizon than Floyd soils. These soils are on convex slopes above Floyd soils.

Typical pedon of Floyd loam, 1 to 4 percent slopes, in a pasture; 450 feet north and 75 feet east of the southwest corner of sec. 30, T. 92 N., R. 16 W.

A1—0 to 17 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; gradual smooth boundary.

A3—17 to 23 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine granular structure; friable; slightly acid; gradual smooth boundary.

B21—23 to 33 inches; olive brown (2.5Y 4/4) loam; common fine faint dark grayish brown (2.5Y 4/2) mottles; moderate fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B22—33 to 45 inches; light olive brown (2.5Y 5/4) sandy loam; common fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5Y 5/6) mottles; moderate medium subangular blocky structure; very friable; few small black (5YR 2/1) and yellowish red (5YR 5/6) iron and manganese oxide concretions; few small pebbles; neutral; gradual smooth boundary.

IIB3—45 to 55 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam; weak medium prismatic structure; firm; few small pebbles; neutral; gradual smooth boundary.

IIC—55 to 60 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) loam; massive; firm; neutral.

The thickness of the solum ranges from 40 to 60 inches, and depth to carbonates ranges from 45 to 75 inches. Thickness of the mollic epipedon ranges from 16 to 24 inches.

The A1 horizon typically is black (10YR 2/1) but ranges to very dark brown (10YR 2/2) and very dark gray (10YR 3/1). The B horizon ranges from dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4).

The A1 horizon commonly is loam but ranges to clay loam. The B horizon ranges from loam to sandy loam and sandy clay loam. Some pedons have 2- to 5-inch strata of loamy sand at the contact of the surficial loamy sediment and the underlying glacial till. The IIB horizon ranges from loam to clay loam and sandy clay loam.

The solum is neutral or slightly acid. The IIC horizon is neutral or mildly alkaline.

Garwin series

The Garwin series consists of poorly drained, moderately permeable soils in drainageways and at the head of drainageways in uplands. These soils formed in 45 to 60 inches of loess overlying glacial till sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Garwin soils are similar to Maxfield soils and are commonly adjacent to Muscatine and Tama soils. Maxfield soils formed in 24 to 40 inches of loess and underlying glacial till. Muscatine and Tama soils have a browner B horizon and better internal drainage than Garwin soils. Muscatine and Tama soils are in more sloping areas of the landscape.

Typical pedon of Garwin silty clay loam, 0 to 2 percent slopes, in a pasture; 1,023 feet east and 95 feet north of the southwest corner of sec. 2, T. 90 N., R. 18 W.

A1—0 to 14 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.

A3—14 to 22 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; few small black (5YR 2/1) and reddish yellow (7.5YR 6/6) iron and manganese oxide concretions; neutral; clear wavy boundary.

B1g—22 to 26 inches; dark gray (5Y 4/1) silty clay loam; few fine distinct olive (5Y 5/4) mottles; weak medium subangular blocky structure; friable; few small black (5YR 2/1) manganese oxide concretions; neutral; clear wavy boundary.

B2g—26 to 31 inches; olive gray (5Y 5/2) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; few small black (5Y 2/1) manganese oxide concretions; neutral; gradual smooth boundary.

B3g—31 to 50 inches; mottled olive gray (5Y 5/2) and light olive brown (2.5Y 5/6) silty clay loam; few olive gray (5Y 5/2) coats on prism faces; weak medium prismatic structure; friable; common small black (5YR 2/1) manganese oxide concretions; neutral; clear smooth boundary.

IIC1—50 to 66 inches; mottled dark yellowish brown (10YR 4/4) and dark grayish brown (10YR 4/2) sandy loam; massive; very friable; neutral; clear smooth boundary.

IIC2—66 to 72 inches; mottled yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) loam; common medium distinct gray (5Y 5/1) mottles; massive; firm; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and depth to glacial till range from about 45 to 60 inches. Depth to carbonates ranges from 48 to 72 inches. Thickness of the mollic epipedon ranges from 16 to 24 inches.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1), and the A3 horizon is very dark gray (10YR 3/1) or black (10YR 2/1). The B horizon ranges from dark gray (5Y 4/1) to olive (5Y 4/2 or 5/2) and has mottles high in chroma.

The Ap and B horizons are neutral or slightly acid. The C horizon is neutral or mildly alkaline.

The sandy loam part of the IIC horizon is 0 to 20 inches thick.

Hanska series

The Hanska series consists of poorly drained soils in drainageways and at the head of drainageways on uplands. These soils formed in 24 to 40 inches of loam and sandy loam sediment overlying loamy sand and sand. Permeability is moderately rapid in the subsoil and rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Hanska soils are commonly adjacent to Hoopeston soils. Hoopeston soils have better internal drainage than Hanska soils and have less clay and more sand in the A horizon. Hoopeston soils are upslope from Hanska soils.

Typical pedon of Hanska loam, 1 to 4 percent slopes, in a cultivated field; 2,026 feet west and 90 feet north of the southeast corner of sec. 30, T. 92 N., R. 17 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (N 3/0) dry; weak medium granular structure; friable; neutral; clear smooth boundary.

A12—9 to 14 inches; black (N 2/0) loam, very dark gray (N 3/0) dry; weak medium granular structure; friable; neutral; clear wavy boundary.

B1g—14 to 18 inches; gray (5Y 5/1) loam; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B2g—18 to 24 inches; gray (5Y 5/1) loam; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B3g—24 to 34 inches; gray (5Y 5/1) fine sandy loam; weak coarse subangular blocky structure; very friable; neutral; gradual smooth boundary.

C1g—34 to 50 inches; gray (5Y 5/1) loamy fine sand; single grain; loose; neutral; clear smooth boundary.

IIC2—50 to 61 inches; yellowish brown (10YR 5/4) loamy coarse sand; single grain; loose; few strong brown (7.5YR 5/6) iron oxide concretions; few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 40 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches.

The A horizon is black (N 2/0 or 10YR 2/1) loam or fine sandy loam. The B horizon is dark gray (5Y 4/1), gray (5Y 5/1), or olive gray (5Y 5/2) loam or fine sandy loam. Typically, these horizons are neutral but range to slightly acid. The C horizon ranges from loamy fine sand to sand and is free of pebbles. The IIC horizon is below a depth of 45 to 60 inches.

Hoopeston series

The Hoopeston series consists of somewhat poorly drained soils on stream benches and on uplands. These soils formed in loamy and sandy alluvial and eolian sediment. Permeability is moderately rapid in the solum and rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Hoopeston soils are commonly adjacent to Dickinson, Hanska, and Sparta soils. Dickinson soils have a browner B horizon than Hoopeston soils and have better internal drainage. Hanska soils have a grayer B horizon and are poorly drained. Sparta soils have less clay, more sand throughout, and better internal drainage. Dickinson and Sparta soils are at a higher elevation in the landscape than Hoopeston soils and Hanska soils are at a lower elevation.

Typical pedon of Hoopeston fine sandy loam, 0 to 2 percent slopes, in a pasture; 325 feet south and 75 feet west of the northeast corner of sec. 6, T. 91 N., R. 17 W.

A11—0 to 10 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; very friable; neutral; gradual smooth boundary.

A12—10 to 20 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; strongly acid; gradual smooth boundary.

B2—20 to 29 inches; dark grayish brown (10YR 4/2) fine sandy loam; common fine faint brown (10YR 4/3) mottles; weak very fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C1—29 to 52 inches; brown (10YR 5/3) sand; common medium faint yellowish brown (10YR 5/6) mottles; single grain; loose; neutral; gradual smooth boundary.

C2—52 to 72 inches; light brownish gray (2.5Y 6/2) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 24 to 36 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches. Depth to loamy sand or sand ranges from 20 to 40 inches.

The Ap and A12 horizons are black (10YR 2/1) or very dark brown (10YR 2/2). Some pedons have an A3 horizon. The B horizon ranges from dark grayish brown (10YR 4/2 or 2.5Y 4/2) to brown (10YR 4/3) and has few to common mottles.

The A and B horizons are commonly fine sandy loam but range to sandy loam. The B horizon of some pedons contains subhorizons less than 6 inches thick that are loam or sandy clay loam. The C horizon ranges from loamy fine sand to sand.

The A and B horizons range from neutral to strongly acid. The C horizon ranges from medium acid to neutral.

Houghton series

The Houghton series consists of very poorly drained soils that are mainly in drainageways on uplands, but in a few areas are on stream benches and flood plains. These soils formed in 51 to more than 120 inches of organic material overlying stratified mineral sediment. Permeability ranges from moderately slow to moderately rapid. Native vegetation was marsh grasses. Slope ranges from 0 to 2 percent.

Houghton soils are similar to Palms soils and are commonly adjacent to Clyde soils. Palms soils formed in 16 to 50 inches of organic material. Clyde soils formed in loamy mineral sediment and are at a slightly higher elevation than Houghton soils.

Typical pedon of Houghton muck, 0 to 2 percent slopes, in a pasture; 2,390 feet south and 1,495 feet west of the northeast corner of sec. 32, T. 92 N., R. 17 W.

Oa1—0 to 8 inches; black (N 2/0, broken face and rubbed) sapric material; about 25 percent fiber, 5 percent when rubbed; weak medium subangular blocky structure; slightly sticky; neutral; gradual smooth boundary.

Oa2—8 to 15 inches; black (N 2/0, broken face), dark reddish brown (5YR 2/2, rubbed) sapric material; few fine distinct reddish brown (5YR 4/4) mottles; about 30 percent fiber, 5 percent rubbed; weak medium platy structure; slightly sticky; slightly acid; gradual smooth boundary.

Oa3—15 to 27 inches; black (5YR 2/1, broken face), dark reddish brown (5YR 2/2, rubbed) sapric material; common medium distinct yellowish red (5YR 4/6) mottles; about 30 percent fiber, 15 percent rubbed; weak very thick platy structure parting to weak medium platy; slightly sticky; slightly acid; gradual smooth boundary.

Oa4—27 to 36 inches; dark reddish brown (5YR 2/2, broken face), dark reddish brown (5YR 3/2, rubbed) sapric material; many medium distinct yellowish red (5YR 4/6) mottles; about 35 percent fiber, 20 percent rubbed; weak very thick platy structure parting to weak thick platy; slightly sticky; slightly acid; gradual smooth boundary.

Oa5—36 to 65 inches; black (10YR 2/1, broken face) sapric material; few fine faint dark brown (7.5YR 3/2) mottles; about 30 percent fiber, 5 percent rubbed; massive; slightly sticky; slightly acid; clear wavy boundary.

IIC—65 to 75 inches; black (10YR 2/1) mucky silt loam; massive; very friable; slightly acid.

The thickness of the organic material typically is 60 to 80 inches but ranges from 51 to 120 inches.

The sapric layers are black (5YR 2/1, 10YR 2/1, or N 2/0) or dark reddish brown (5YR 2/2) and typically have a few mottles high in chroma. Some pedons have thin hemic layers with a total thickness less than 10 inches. They range from dark reddish brown (5YR 2/2) to brown (7.5YR 4/4) and typically have common to many mottles high in chroma. The organic layers are neutral or slightly acid. The IIC horizon ranges from black (N 2/0) to greenish gray (5GY 6/1) and olive gray (5Y 5/2) and does not have mottles or has many mottles high in chroma. It typically is stratified and ranges from silty clay loam to sandy loam. In places there are thin mucky lenses.

Kenyon series

The Kenyon series consists of moderately well drained, moderately permeable soils on ridge crests and side slopes on uplands. These soils formed in about 13 to 26 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 2 to 14 percent.

The Kenyon soils are similar to Ostrander and Readlyn soils and are commonly adjacent to Bassett, Cresco, Dinsdale, Olin, Readlyn, and Tripoli soils. Ostrander soils are more stratified than Kenyon soils and are deeper to glacial till. Readlyn and Tripoli soils are grayer in the upper part of the B horizon and are more poorly drained. Bassett soils have a thinner A horizon than Kenyon soils. Cresco soils have higher clay content in the B horizon. Dinsdale soils contain less sand in the A horizon and upper part of the B horizon. Olin soils contain more sand in the A horizon and upper part of the B horizon. Bassett, Cresco, Dinsdale, and Olin soils are on landscape positions similar to those of Kenyon soils. Readlyn and Tripoli soils are less sloping and are above the Kenyon soils.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, in a cultivated field; 1,680 feet south and 335 feet west of the northeast corner of sec. 8, T. 93 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3—8 to 16 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine and very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

IIB1—16 to 20 inches; brown (10YR 4/3) loam; few dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; pebble band in upper part of horizon; few small pebbles throughout horizon; medium acid; clear smooth boundary.

IIB21—20 to 28 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few small pebbles; medium acid; clear wavy boundary.

IIB22—28 to 35 inches; yellowish brown (10YR 5/4) loam, light brownish gray (10YR 6/2) dry; grayish brown (10YR 5/2) coatings on faces of prisms and peds; weak medium prismatic structure parting to weak medium subangular blocky; firm; few dark reddish brown (5YR 2/2) manganese oxide concretions; few small pebbles; medium acid; gradual smooth boundary.

IIB3—35 to 49 inches; yellowish brown (10YR 5/6) loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few small pebbles; neutral; clear wavy boundary.

IIC—49 to 66 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; few strong brown (7.5YR 5/8) iron oxide concretions; massive; firm; few lime concretions and soft lime accumulations; strong effervescence; mildly alkaline.

The thickness of the solum is commonly the same as the depth to carbonates and typically ranges from 45 to 66 inches. Thickness of the mollic epipedon ranges from 10 to 18 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). If eroded, the Ap horizon can be dark brown (10YR 3/3). The IIB horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6) and has mottles of 2 chroma below a depth of 20 to 36 inches.

The A and B1 horizons typically are loam but in some pedons are silt loam high in sand. The IIB horizon typically is loam but ranges to sandy clay loam and clay loam.

The Ap horizon ranges from neutral to medium acid. The A3, B1, IIB1, and IIB2 horizons are medium acid. The IIB3 horizon is slightly acid or neutral. The IIC horizon is neutral or mildly alkaline.

In map units 83C2 and 83D2, the dark surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of these soils.

Klinger series

The Klinger series consists of somewhat poorly drained, moderately permeable soils on broad, slightly convex ridges and side slopes on uplands. These soils formed in 22 to 40 inches of loess and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Klinger soils are commonly adjacent to Dinsdale, Maxfield, and Waubeek soils. Dinsdale soils have a browner B horizon and are better drained than Klinger soils. Maxfield soils have a grayer B horizon and are more poorly drained. Waubeek soils have a browner B horizon. Dinsdale and Waubeek soils are more sloping and are below Klinger soils. Maxfield soils are less sloping and are above Klinger soils.

Typical pedon of Klinger silty clay loam, 1 to 3 percent slopes, in a cultivated field; 1,410 feet east and 72 feet south of the northwest corner of sec. 21, T. 90 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A3—15 to 19 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak medium subangular blocky structure parting to moderate medium granular; friable; medium acid; clear wavy boundary.

B21—19 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; medium acid; clear smooth boundary.

B22—27 to 31 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

IIB23—31 to 52 inches; yellowish brown (10YR 5/6) loam; common medium distinct dark grayish brown (2.5Y 4/2) mottles; light olive brown (2.5Y 5/4) coatings on faces of prisms; moderate medium prismatic structure; firm; pebble band in upper part; few small pebbles throughout; neutral; clear wavy boundary.

IIC—52 to 60 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 6/1) mottles; massive; firm; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. Depth to carbonates ranges from about 45 to 60 inches. Thickness of the mollic epipedon ranges from 16 to 24 inches.

The A horizon is black (10YR 2/1) in the upper part and black (10YR 2/1) to very dark grayish brown (10YR 3/2) in the lower part. The B horizon typically is dark grayish brown (10YR 4/2 or 2.5Y 4/2) with few or common mottles but ranges to olive brown (2.5Y 4/4).

The IIB and IIC horizons typically are loam but range to clay loam.

The Ap horizon ranges from slightly acid to medium acid. The lower part of the A horizon and the B horizon are slightly acid or medium acid. The IIB horizon is neutral or slightly acid. The IIC horizon is mildly alkaline.

Lamont series

The Lamont series consists of well drained and somewhat excessively drained soils on uplands. Permeability is moderately rapid. These soils formed in eolian sandy materials. Native vegetation was prairie grasses and trees. Slope ranges from 2 to 9 percent.

Lamont soils are similar to Backbone soils and are commonly adjacent to Backbone and Chelsea soils. Backbone soils are underlain by limestone bedrock. Chelsea soils contain more sand than Lamont soils. Backbone soils are on side slopes below Lamont soils. Chelsea soils are on landscape positions similar to those of Lamont soils.

Typical pedon of Lamont fine sandy loam, 2 to 5 percent slopes, in timbered pasture; 2,458 feet south and 726 feet east of the northwest corner of sec. 26, T. 93 N., R. 16 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; medium acid; clear wavy boundary.

A2—5 to 10 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; few dark grayish brown (10YR 4/2) coatings on horizontal faces of peds; very weak medium and thin platy structure; very friable; medium acid; clear wavy boundary.

B21t—10 to 18 inches; brown (10YR 4/3) fine sandy loam, very weak fine subangular blocky structure; very friable; thin discontinuous dark yellowish brown (10YR 3/4) clay films; sand grains are coated and bridged with clay; strongly acid; gradual smooth boundary.

B22t—18 to 29 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; thin discontinuous dark brown (10YR 3/3) clay films; sand grains are coated and bridged with clay; medium acid; gradual smooth boundary.

B3t—29 to 38 inches; brown (7.5Y 4/4) loamy sand; very weak coarse subangular blocky structure; very friable; thin discontinuous dark brown (10YR 3/3) clay films; sand grains are coated and bridged with clay; medium acid; gradual smooth boundary.

C—38 to 60 inches; brown (7.5YR 4/4) loamy sand; single grain; loose; brown (7.5YR 4/4) sandy loam lamellae between 55 and 57 inches; medium acid.

The thickness of the solum ranges from 30 to 60 inches or more.

The A1 horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark gray (10YR 4/1) sandy loam or fine sandy loam 2 to 5 inches thick. The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). It is 6 to 10 inches thick. The A2 horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 5/3) fine sandy loam 3 to 6 inches thick.

Some pedons have a B1 horizon. The Bt horizon ranges from brown (7.5YR 4/4) to strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4). Typically, it is fine sandy loam but ranges to loam.

Typically, the C horizon is sandy loam or loamy sand and lamellae are 1/2 inch to 2 inches thick. The lamellae have hue of 7.5YR and 10YR and value and chroma of 3 or 4. The total thickness of the lamellae above a depth of 60 inches is less than 6 inches.

The Ap horizon ranges from neutral to medium acid, and below this the pedon is medium acid or strongly acid.

Lawler series

The Lawler series consists of somewhat poorly drained soils on stream benches and a few uplands. These soils formed in 24 to 40 inches of loamy sediment underlain by loamy sand or sand that contains some gravel. Permeability is moderate in the solum and very rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Lawler soils are commonly adjacent to Marshan, Saude, Waukee, and Waukegan soils. Saude, Waukee, and Waukegan soils have a browner B horizon and are better drained than Lawler soils. Waukegan soils have less sand in the A horizon and upper part of the B horizon. Marshan soils have a grayer B horizon and are more poorly drained than Lawler soils. Saude, Waukee, and Waukegan soils are in slightly higher lying areas than Lawler soils. Marshan soils are in lower lying areas.

Typical pedon of Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 1,620 feet south and 520 feet west of the northeast corner of sec. 22, T. 91 N., R. 17 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A3—8 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak medium subangular blocky structure parting to moderate fine granular; friable; medium acid; gradual smooth boundary.

B1—14 to 19 inches; very dark grayish brown (2.5Y 3/2) clay loam; few very dark brown (10YR 2/2) coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B2—19 to 31 inches; dark grayish brown (2.5Y 4/2) loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; very few small pebbles; medium acid; clear smooth boundary.

B3—31 to 35 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; common dark reddish brown (5YR 2/2) manganese oxide concretions; medium acid; clear smooth boundary.

IIC1—35 to 51 inches; brown (7.5YR 4/4) loamy coarse sand; common fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; few small pebbles; slightly acid; gradual smooth boundary.

IIC2—51 to 64 inches; brown (10YR 5/3) coarse and very coarse sand; single grain; loose; few small pebbles; slightly acid.

The thickness of the solum and depth to loamy sand or sand are 24 to 40 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches.

The Ap or A1 horizon is dominantly black (10YR 2/1). The A3 horizon, where present, typically is very dark grayish brown (10YR 3/2). The B2 horizon is dark grayish brown (10YR 4/2) and has few to many mottles of light olive brown (2.5Y 5/6) and few to many grayish mottles.

The A horizon is generally loam or silt loam high in sand. The B2 horizon is mainly loam but ranges to sandy clay loam.

The A horizon ranges from neutral to medium acid, and the B and IIC horizons are slightly acid or medium acid.

Lourdes series

The Lourdes series consists of moderately well drained soils on ridge crests and upper side slopes on uplands. These soils formed in 13 to 22 inches of loamy sediment and the underlying, very firm glacial till. Permeability is moderately slow. Native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Lourdes soils are commonly adjacent to Bassett and Riceville soils. Bassett soils have less clay and are less firm in the IIB and IIC horizons than Lourdes soils. Riceville soils are somewhat poorly drained and are less sloping. Both soils are on landscape positions similar to those of Lourdes soils.

Typical pedon of Lourdes loam, 2 to 5 percent slopes, in a cultivated area; 2,563 feet north and 2,510 feet west of the southeast corner of sec. 24, R. 92 N., T. 16 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—7 to 14 inches; dark yellowish brown (10YR 4/4) clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

IIB21t—14 to 20 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct gray (5Y 5/1) mottles; nearly continuous light gray (5Y 6/1) coatings on faces of peds; moderate fine subangular structure; very firm; thin discontinuous dark grayish brown (10YR 4/2) clay films; incipient pebble band at top of horizon; few small pebbles throughout; strongly acid; gradual smooth boundary.

IIB22t—20 to 40 inches; yellowish brown (10YR 5/6) clay loam; light gray (5Y 6/1) coatings on faces of prisms and peds; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous dark gray (10YR 4/1) clay films on prism and ped faces; few very dark gray (10YR 3/1) clay films in pores and root channels; few small pebbles; medium acid; clear wavy boundary.

IIB3—40 to 48 inches; yellowish brown (10YR 5/6) clay loam; light gray (5Y 5/1) coatings on faces of prisms; moderate fine prismatic structure; very firm; few soft white (10YR 8/1) lime accumulations; few small pebbles; strong effervescence; mildly alkaline; gradual smooth boundary.

IIC—48 to 72 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct gray (5Y 5/1) mottles; massive; very firm; few small black manganese oxide concretions; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 40 to 60 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. Some pedons have an A2 horizon 2 to 6 inches thick. The coatings on the prisms and peds in the upper part of the IIB2 horizon range from brown (10YR 4/3) and dark grayish brown (2.5Y 4/2) to gray (5Y 6/1). Depth to gray coatings ranges from 14 to 26 inches.

The average clay content in the IIB horizon ranges from 30 to 35 percent but the subhorizons in some pedons have as much as 37 percent clay.

The Ap or A1 horizon is neutral to medium acid. The IIB horizon is medium acid to very strongly acid, and the IIB3 and IIC horizons are neutral to mildly alkaline.

Marshan series

The Marshan series consists of poorly drained soils on stream benches and drainageways extending into uplands. These soils formed in 24 to 40 inches of loamy sediment overlying loamy sand and gravel. Permeability is moderate in the solum and rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

The Marshan soils are commonly adjacent to the Lawler, Thorp, and Waukee soils. Lawler and Waukee soils have a browner B horizon than Marshan soils and are better drained. Thorp soils have a thick A2 horizon and are deeper to coarse textured material. Lawler and Waukee soils are slightly higher lying than Marshan soils, and Thorp soils are slightly lower lying.

Typical pedon of Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 1,740 feet west and 50 feet north of the southeast corner of sec. 13, T. 93 N., R. 16 W.

Ap—0 to 8 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 15 inches; black (N 2/0) silty clay loam, high in sand, very dark gray (N 3/0) dry; few fine distinct dark grayish brown (2.5Y 4/2) mottles in lower 2 inches; moderate fine granular structure; friable; neutral; gradual smooth boundary.

B1—15 to 20 inches; very dark gray (10YR 3/1) clay loam; common fine distinct dark grayish brown (2.5Y 4/2) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B21g—20 to 24 inches; grayish brown (2.5Y 5/2) clay loam, common fine faint light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

B22g—24 to 32 inches; olive gray (5Y 5/2) clay loam; few fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; few strong brown (7.5YR 5/6) iron oxide concretions; neutral; clear smooth boundary.

B3g—32 to 35 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct light olive brown (2.5Y 5/4) mottles; very weak medium subangular blocky structure; very friable; neutral; clear smooth boundary.

IIC1g—35 to 41 inches; light brownish gray (2.5Y 6/2) loamy sand; common medium distinct strong brown (7.5YR 5/6) mottles; massive; loose; about 6 percent fine gravel; neutral; clear smooth boundary.

IIC2—41 to 60 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8) and grayish brown (2.5Y 5/2) coarse sand; single grain; loose; about 15 percent fine gravel and 3 percent 2- to 7-inch pebbles and cobbles; neutral.

The thickness of the solum and depth to loamy sand, sand, or gravelly sand range from 24 to 40 inches. Depth to carbonates ranges from 50 to 72 inches or more. Thickness of the mollic epipedon ranges from 14 to 24 inches.

The Ap or A1 horizon is black (N 2/0). The A3 horizon, where present, is very dark gray (10YR 3/1). The A horizon typically is clay loam but ranges to silty clay loam high in sand and loam.

The B2 horizon ranges from grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) and from loam to silty clay loam high in sand. The B3 horizon is commonly sandy loam or sandy clay loam 0 to 5 inches thick.

The IIC horizon ranges from sand to gravelly sand with layers of loamy sand. The soil is neutral or slightly acid throughout.

Maxfield series

The Maxfield series consists of poorly drained, moderately permeable soils in drainageways, at the head of drainageways, and on broad upland divides. These soils formed in about 24 to 40 inches of loess and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Maxfield soils are similar to Garwin soils and commonly are adjacent to Dinsdale and Klinger soils. Dinsdale and Klinger soils have a browner B horizon than Maxfield soils. They are not so poorly drained, are more sloping, and are below Maxfield soils. Garwin soils are deeper to the underlying glacial till and have less sand in the A horizon and upper part of the B horizon.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, in a cultivated field; 660 feet south and 315 feet west of the northeast corner of sec. 20, T. 90 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

A12—8 to 18 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; few dark reddish brown (5YR 2/2) manganese oxide concretions; neutral; clear smooth boundary.

B1g—18 to 24 inches; olive gray (5Y 5/2) silty clay loam; few fine distinct olive brown (2.5Y 4/4) mottles; discontinuous very dark gray (5Y 3/1) coatings on faces of peds; moderate fine subangular blocky structure; friable; few dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/6) iron and manganese oxide concretions; neutral; clear wavy boundary.

B2g—24 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct olive gray (5Y 5/2) and common fine faint light olive brown (2.5Y 5/6) mottles; few olive gray (5Y 5/2) coatings on faces of peds; weak medium subangular blocky structure; friable; common small dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/6) iron and manganese oxide concretions; neutral; clear smooth boundary.

IIB3—34 to 43 inches; yellowish brown (10YR 5/6) loam; common fine distinct grayish brown (2.5Y 5/2) and common fine faint strong brown (7.5YR 5/8) mottles; weak fine prismatic structure; firm; common small dark reddish brown (5YR 2/2) manganese oxide concretions; sandy loam in upper 1 inch; few small pebbles; neutral; clear wavy boundary.

IIC—43 to 80 inches; yellowish brown (10YR 5/6) loam; few fine distinct gray (5Y 5/1) mottles; massive; firm; few small strong brown (7.5YR 5/8) iron oxide concretions; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 55 inches. Depth to carbonates ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 14 to 24 inches.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1). The A3 horizon, where present, is very dark gray (10YR 3/1). The B horizon ranges from dark grayish brown (2.5Y 4/2) with high value and low chroma mottles to olive gray (5Y 5/2).

The IIB and IIC horizons typically are loam but range to clay loam and sandy clay loam.

The solum typically is neutral but ranges to slightly acid. The IIC horizon is neutral or mildly alkaline.

Mt. Carroll series

The Mt. Carroll series consists of well drained, moderately permeable soils on narrow ridge crests and on side slopes. These soils formed in loess. Native

vegetation was prairie grasses and trees. Slope ranges from 9 to 25 percent.

Mt. Carroll soils are similar to Downs and Waubeek soils and are commonly adjacent to Downs and Worthen soils. Downs soils have more clay in the B horizon and are more sloping than Mt. Carroll soils. Waubeek soils have less sand in the lower part of the B horizon and the C horizon. Worthen soils have a thicker A horizon and are on foot slopes below Mt. Carroll soils.

Typical pedon of Mt. Carroll silt loam, 9 to 14 percent slopes in a wooded area; 1,640 feet east and 50 feet north of the center of sec. 19, T. 90 N., R. 15 W.

A1—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to moderate fine subangular blocky; friable; neutral; clear wavy boundary.

B1—11 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2t—14 to 21 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on peds and in pores and root channels; slightly acid; gradual smooth boundary.

B3—21 to 38 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; medium acid; gradual smooth boundary.

C1—38 to 62 inches; dark yellowish brown (10YR 4/4) silt loam; common medium distinct light olive gray (5Y 6/2) mottles; massive; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—62 to 72 inches; light olive gray (5Y 6/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 35 to 50 inches. Depth to carbonates and olive gray mottles ranges from 30 to more than 60 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon ranges from very dark brown (10YR 2/2) or very dark gray (10YR 3/1) to dark brown (10YR 3/3). The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is 0 to 5 inches thick. The B horizon typically is dark yellowish brown (10YR 4/4) but ranges to brown (10YR 4/3) in the B1 horizon and to yellowish brown (10YR 5/4) in the B2 and B3 horizons. About 50 percent of the C horizon has grayish mottles.

The A horizon ranges from neutral to medium acid. The B horizon is slightly acid or medium acid. The C horizon ranges from medium acid to mildly alkaline.

In map units 662D3 and 662F3, the dark colored surface layer is thinner than required for the series, but this difference does not alter the usefulness or behavior of these soils.

Muscatine series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils on broad, slightly concave side slopes on uplands. These soils formed in 45 to 60 inches of loess overlying glacial till sediment. Native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Muscatine soils are similar to Ely soils and are commonly adjacent to Garwin and Tama soils. Ely soils have a thicker A horizon than Muscatine soils. Garwin soils have a grayer B horizon. Tama soils have a browner B horizon and better internal drainage. Garwin soils are in less sloping areas. Tama soils are in more sloping areas.

Typical pedon of Muscatine silty clay loam, 1 to 3 percent slopes, in a cultivated field; 1,330 feet east and 133 feet south of the northwest corner of sec. 7, T. 90 N., R. 17 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

A12—8 to 21 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; friable; neutral; clear wavy boundary.

B1—21 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few very dark gray (10YR 3/1) coatings on faces of peds; moderate very fine subangular blocky structure; friable; few small strong brown (7.5YR 5/8) iron oxide concretions; neutral; gradual smooth boundary.

B2—26 to 35 inches; olive brown (2.5Y 4/4) silty clay loam; discontinuous dark grayish brown (2.5Y 4/2) coatings on faces of peds; weak medium subangular blocky structure; friable; few small dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/8) iron and manganese oxide concretions; neutral; gradual smooth boundary.

B3—35 to 54 inches; light olive brown (2.5Y 5/4) silty clay loam; common fine distinct grayish brown (2.5Y 5/2) mottles; common small dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/8) iron and manganese oxide concretions; neutral; clear smooth boundary.

IIC1—54 to 58 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct grayish brown (2.5Y 5/2) mottles; massive; very friable; few small pebbles; neutral; clear smooth boundary.

IIC2—58 to 64 inches; mottled yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) loam; common medium distinct gray (5Y 5/1) mottles; massive; firm; few small pebbles; neutral; clear wavy boundary.

IIC3—64 to 72 inches; mottled yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) loam; common medium distinct gray (5Y 5/1) mottles; massive; firm; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and depth to glacial till sediment range from about 45 to 60 inches. Depth to carbonates ranges from 48 to 72 inches. Thickness of the mollic epipedon ranges from 16 to 24 inches.

The A horizon is black (10YR 2/1) in the upper part and black (10YR 2/1) or very dark brown (10YR 2/2) in the lower part. The B horizon ranges from dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4) and has few or common mottles.

The solum is neutral or slightly acid, and the C horizon is neutral or mildly alkaline.

The sandy loam part of the IIC horizon is 0 to 20 inches thick.

Nevin series

The Nevin series consists of somewhat poorly drained, moderately permeable soils on stream benches. These soils formed in silty alluvium. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Nevin soils in Butler County differ from Nevin soils in other areas because typically they do not have the increase in clay necessary for an argillic horizon. This difference does not alter the use or behavior of these soils.

Nevin soils are commonly adjacent to Bremer and Raddle soils. Bremer soils are slightly lower on the landscape and have poorer internal drainage than Nevin soils. Raddle soils have a browner B horizon, are better drained, and are at a slightly higher elevation than Nevin soils.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, in a cultivated field; 225 feet south and 110 feet west of the northeast corner of sec. 27, T. 90 N., R. 17 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 16 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; medium acid; gradual smooth boundary.

A3—16 to 23 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; very weak fine subangular blocky structure; friable; few light brownish gray (10YR 6/2) fine sand grains on ped faces when dry; medium acid; clear wavy boundary.

B1—23 to 28 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) loam; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; medium acid; clear wavy boundary.

B2t—28 to 33 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; discontinuous dark grayish brown (2.5Y 4/2) coatings on faces of peds; weak medium subangular blocky structure; friable; thin discontinuous very dark grayish brown (2.5Y 3/2) clay films; few light brownish gray (10YR 6/2) fine sand coats on faces when dry; slightly acid; gradual smooth boundary.

B3t—33 to 44 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silty clay loam; weak coarse subangular blocky structure; friable; thin discontinuous dark grayish brown (2.5Y 4/2) clay films; medium acid; gradual smooth boundary.

C1—44 to 62 inches; mottled brownish yellow (10YR 6/8) and light brownish gray (2.5Y 6/2) silt loam; massive; friable; common dark reddish brown (5YR 2/2) manganese oxide concretions; slightly acid; clear smooth boundary.

C2—62 to 74 inches; light olive gray (5Y 6/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few red (2.5YR 4/8) iron oxide concretions; neutral.

The thickness of the solum typically is more than 40 inches but ranges from 36 to 60 inches. Thickness of the mollic epipedon ranges from 24 to 30 inches.

The A horizon is black (10YR 2/1) and very dark gray (10YR 3/1). The B1 horizon is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2). The B2 and B3 horizons range from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2) and have few to many mottles.

The Ap horizon ranges from neutral to medium acid. The lower part of the A horizon and the B horizon are slightly acid or medium acid. The C horizon is slightly acid or neutral.

Olin series

The Olin series consists of well drained and somewhat excessively drained soils on upland ridge crests and side slopes. These soils formed in about 20 to 36 inches of sandy loam and the underlying glacial till. Permeability is moderately rapid in the upper part of the solum and moderate in the lower part of the solum and the substratum. Native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

The Olin soils are commonly adjacent to Dickinson, Kenyon, and Sparta soils. Dickinson and Sparta soils are deeper to glacial till than Olin soils. Kenyon soils have less sand in the upper part of the solum. The Dickinson, Kenyon, and Sparta soils are on landscape positions similar to those of Olin soils.

Typical pedon of Olin fine sandy loam, 2 to 5 percent slopes, in a cultivated area; 1,940 feet west and 100 feet south of the northeast corner of sec. 6, T. 92 N., R. 15 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; neutral; clear smooth boundary.

A3—9 to 17 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; neutral; gradual smooth boundary.

B1—17 to 23 inches; dark brown (10YR 3/3) fine sandy loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; very friable; neutral; clear wavy boundary.

B2—23 to 30 inches; yellowish brown (10YR 5/4) sandy loam; nearly continuous brown (10YR 4/3) coatings on faces of peds; weak fine and medium subangular blocky structure; very friable; medium acid; clear smooth boundary.

IIB3—30 to 46 inches; dark yellowish brown (10YR 4/4) clay loam; few fine faint yellowish brown (10YR 5/6) mottles; discontinuous dark grayish brown (2.5Y 4/2) coatings on faces of prisms; moderate fine prismatic structure; firm; few small pebbles; medium acid; gradual smooth boundary.

IIC—46 to 72 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 5/1) mottles; massive; firm; few small pebbles; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to carbonates ranges from 50 to 80 inches. Thickness of the mollic epipedon ranges from 14 to 24 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A and B1 horizons typically are fine sandy loam but range to sandy loam. The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). It is mainly sandy loam but in some pedons has layers of loamy sand 1 to 5 inches thick. In many pedons, a pebble band is at the place of contact of the sandy loam and glacial till. The IIB horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6).

The A and B1 horizons are neutral to medium acid, and the B2 and IIB horizons are medium acid. The IIC horizon ranges from slightly acid to mildly alkaline.

Ostrander series

The Ostrander series consists of well drained, moderately permeable soils on ridge crests, side slopes, and low benchlike positions on uplands. These soils formed in 14 to 26 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Ostrander soils are similar to Kenyon soils and are commonly adjacent to Floyd and Kenyon soils. Kenyon and Readlyn soils are less stratified and are shallower to glacial till than Ostrander soils. Floyd and Readlyn soils are somewhat poorly drained and are on slightly lower landscape positions. Kenyon soils are on landscape positions similar to those of Ostrander soils.

Typical pedon of Ostrander loam, 2 to 5 percent slopes, in a cultivated area; 200 feet south and 55 feet east of the northwest corner of sec. 22, T. 93 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 15 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; clear wavy boundary.

B1—15 to 21 inches; brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

IIB21- -21 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak medium subangular blocky structure; very friable; few small very dark grayish brown (10YR 3/2) worm casts; pebble band near top of horizon; few small pebbles throughout; medium acid; gradual smooth boundary.

IIB22—26 to 36 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; very friable; common small pebbles; medium acid; clear wavy boundary.

IIB31—36 to 42 inches; yellowish brown (10YR 5/6) coarse sandy loam; weak coarse subangular blocky structure; very friable; few yellowish red (5YR 4/6) iron oxide concretions; common small pebbles; medium acid; clear smooth boundary.

IIIB32—42 to 53 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; firm; common yellowish red (5YR 4/6) and dark reddish brown (5YR 2/2) iron and manganese oxide concretions; strongly acid; gradual smooth boundary.

IIIC—53 to 72 inches; stratified and mixed strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) sandy clay loam and clay loam; massive; firm; strongly acid.

The thickness of the solum ranges from 44 to 76 inches and depth to carbonates ranges from 50 to 80 inches. Thickness of the mollic epipedon ranges from 10 to 18 inches.

The A horizon ranges from black (10YR 2/1) to very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2). The A and B1 horizons typically are loam, but in some pedons the A horizon is silt loam high in sand. The IIB horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/8) and dark yellowish brown (10YR 4/4). It is dominantly loam, sandy loam, or sandy clay loam but ranges to include thin subhorizons of loamy sand. The IIIC horizon ranges from stratified, friable sandy loam and loam to unstratified, firm loam or sandy clay loam.

The A and B1 horizons are medium acid to neutral, and the IIB and IIIB horizons are medium acid or strongly acid. The IIIC horizon is strongly acid to mildly alkaline.

In map unit 394C2, the dark colored surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Palms series

The Palms series consists of very poorly drained organic soils. These soils are mainly on lower parts of hillsides and in drainageways on uplands. In a few places, they are on stream benches and flood plains. These soils formed in 16 to 50 inches of organic material overlying loamy mineral sediment. Permeability is moderately slow to moderately rapid in the upper part of the soil and moderate to moderately slow in the lower part. Native vegetation was grasses tolerant to wetness. Slope ranges from 2 to 5 percent.

Palms soils are similar to Houghton soils and are commonly adjacent to Clyde soils. Houghton soils have an organic layer ranging from 51 inches to many feet in thickness. Clyde soils formed in loamy mineral sediment and the underlying glacial till and are on slightly higher landscape positions than Palms soils.

Typical pedon of Palms muck, 2 to 5 percent slopes in an uncultivated pasture; 960 feet south and 720 feet west of the northeast corner of sec. 1, T. 91 N., R. 16 W.

Oa1—0 to 18 inches; black (10YR 2/1, broken face and rubbed sapric material; about 30 percent fibers, 10 percent rubbed; fibers are herbaceous; moderate very fine granular structure; slightly sticky; neutral; gradual smooth boundary.

Oa2—18 to 30 inches; black (N 2/0, broken face and rubbed) sapric material; about 25 percent fibers, 10 percent rubbed; fibers are herbaceous; thick platy fragments parting to moderate fine granular structure; slightly sticky; slightly acid; clear smooth boundary.

IIC1g—30 to 37 inches; gray (5Y 5/1) clay loam with some very dark gray (5Y 3/1); few medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; few small pebbles; slightly acid; gradual smooth boundary.

IIC2—37 to 60 inches; very dark gray (10YR 3/1) clay loam; massive; friable; few small pebbles; neutral; gradual smooth boundary.

The thickness of the organic material typically is 20 to 42 inches but ranges from 16 to 50 inches.

The organic layer is black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). It is primarily sapric material, but hemic material 10 inches or less in thickness is present in some pedons. The IIC horizon ranges from black (N 2/0 or 10YR 2/1) to light olive gray (5Y 6/2) and can have common mottles in high chroma.

The IIC horizon ranges from silty clay loam to sandy loam.

The organic layer is slightly acid or neutral. The IIC horizon is slightly acid to mildly alkaline.

Protivin series

The Protivin series consists of somewhat poorly drained soils on lower side slopes on uplands. These soils formed in 16 to 28 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Protivin soils are commonly adjacent to Clyde, Cresco, and Kenyon soils. Clyde soils have a grayer subsoil and are more poorly drained than Protivin soils. Clyde soils also contain less clay and are more stratified in the upper and middle parts of the profile. They are downslope from Protivin soils. Cresco and Kenyon soils are better drained, have a browner subsoil than Protivin soils, and are upslope from Protivin soils.

Typical pedon of Protivin clay loam, 1 to 4 percent slopes, in a cultivated area; 1,360 feet west and 70 feet north of the southeast corner of sec. 18, T. 93 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 16 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; clear wavy boundary.

A3—16 to 22 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; nearly continuous very dark gray (10YR 3/1) coatings on faces of peds; few fine faint dark grayish brown (2.5Y 4/2) mottles; moderate fine subangular blocky structure; friable; medium acid; clear smooth boundary.

IIB21t—22 to 27 inches; mottled light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) clay loam; nearly continuous dark grayish brown (2.5Y 4/2) coatings on faces of peds; moderate fine subangular blocky structure; friable; thin discontinuous very dark grayish brown (2.5Y 3/2) clay films; pebble band in upper part of horizon; few pebbles throughout; slightly acid; clear wavy boundary.

IIB22—27 to 40 inches; mottled yellowish brown (10YR 5/6) and gray (5Y 5/1) clay loam; nearly continuous gray (5Y 5/1) coatings on faces of prisms and peds; moderate medium prismatic structure parting to moderate medium subangular blocky structure; very firm; few strong brown (7.5YR 5/8) and dark reddish brown (5YR 2/2) iron and manganese oxide concretions; few small pebbles; neutral; gradual smooth boundary.

IIB3—40 to 56 inches; mottled yellowish brown (10YR 5/6) and gray (5Y 5/1) clay loam; weak medium prismatic structure; very firm; few small pebbles; neutral; clear wavy boundary.

IIC—56 to 72 inches; mottled yellowish brown (10YR 5/6) and gray (5Y 5/1) clay loam; massive; very firm; strong effervescence; mildly alkaline.

The thickness of the solum is commonly the same as depth to carbonates and typically ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 15 to 24 inches.

The Ap and A12 horizons typically are black (10YR 2/1). The A3 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR or 2.5Y 3/2). The coatings on the prisms and peds in the upper part of the IIB2 horizon range from dark grayish brown (2.5Y 4/2) to gray (5Y 6/1).

The A horizon is loam, clay loam, and silty clay loam high in sand. The average clay content of the IIB horizon ranges from 30 to 35 percent, but in subhorizons of some pedons clay content is as much as 37 percent.

The Ap horizon is neutral or slightly acid. The lower part of the A horizon and the B1 horizon are slightly acid or medium acid; and the IIB horizon is slightly acid or neutral. The IIC horizon is neutral or mildly alkaline.

Raddle series

The Raddle series consists of well drained, moderately permeable soils on stream benches. These soils formed in 50 to 70 inches of silty alluvial sediment overlying gravelly sand or loamy sand. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Raddle soils are commonly adjacent to Bremer, Nevin, and Thorp soils. Bremer, Nevin, and Thorp soils have a grayer B horizon and are not so well drained as Raddle soils. Thorp soils also have a thick A2 horizon and are at a lower elevation than Raddle soils.

Typical pedon of Raddle silt loam, 0 to 2 percent slopes, in a cultivated area; 1,430 feet west and 2,120 feet north of the southeast corner of sec. 34, T. 92 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; neutral; gradual smooth boundary.

B1—14 to 21 inches; dark brown (10YR 3/3) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine subangular blocky structure; friable; few light gray (10YR 7/1) coatings on peds when dry; neutral; clear wavy boundary.

B2—21 to 30 inches; dark yellowish brown (10YR 4/4) silt loam; dark yellowish brown (10YR 3/4) coatings on faces of peds; weak fine subangular blocky structure; friable; few light gray (10YR 7/1) coatings on peds when dry; neutral; gradual smooth boundary.

B3—30 to 43 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

C1—43 to 50 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few reddish brown (5YR 4/4) and yellowish red (5YR 4/6) iron oxide concretions; neutral; abrupt smooth boundary.

C2—50 to 60 inches; gray (5Y 6/1) silty clay loam; massive; firm; common dark reddish brown (2.5YR 3/4) and red (2.5YR 4/8) iron oxide concretions, neutral; abrupt smooth boundary.

IIC3—60 to 80 inches; brown (10YR 4/3) loamy coarse sand; single grain; loose; few small pebbles; neutral.

The thickness of the solum ranges from 40 to 60 inches. Thickness of the mollic epipedon ranges from 12 to 24 inches. Depth to the coarse textured IIC horizon typically is 50 to 70 inches.

The upper part of the A horizon is black (10YR 2/1) or very dark brown (10YR 2/2), and the lower part is very dark brown (10YR 2/2) or very dark grayish brown

(10YR 3/2). The B1 horizon ranges from dark brown (10YR 3/3) to dark yellowish brown (10YR 4/4). The B2 and B3 horizons are brown (10YR 4/3 or 7.5YR 4/4) or dark yellowish brown (10YR 4/4). The C horizon has colors similar to those of the B horizons above a depth of 48 inches. Below 48 inches, the color of the C horizon ranges from gray (5Y 6/1) to dark yellowish brown (10YR 4/4).

The B2 and B3 horizons typically are silt loam, but the B3 horizon ranges to include thin strata of loam and very fine sandy loam. The C horizon has texture similar to that of the B horizon above a depth of 48 inches. Below 48 inches, it is stratified silt loam, silty clay loam, and loamy fine sand free of pebbles. The IIC horizon is sand or loamy sand and contains few to many pebbles.

The Ap horizon ranges from neutral to medium acid. The lower part of the A horizon and the B horizon are neutral to medium acid. The C and IIC horizons are neutral or slightly acid.

Readlyn series

The Readlyn series consists of somewhat poorly drained, moderately permeable soils on broad ridge crests and side slopes on uplands. These soils formed in 14 of 24 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Readlyn soils are similar to Kenyon soils and are commonly adjacent to Kenyon, Ostrander, and Tripoli soils. Kenyon soils are browner in the upper part of the B horizon than Readlyn soils and are better drained. Ostrander soils are well drained and are more stratified in the IIB horizon. Tripoli soils are grayer in the upper part of the B horizon and are more poorly drained. Kenyon and Ostrander soils are upslope from Readlyn soils, and Tripoli soils are downslope.

Typical pedon of Readlyn silty clay loam, 1 to 3 percent slopes, in a cultivated area; 1,035 feet east and 340 feet south of the northwest corner of sec. 30, T. 92 N., R. 16 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; medium acid; clear wavy boundary.

B1—12 to 17 inches; dark grayish brown (10YR 4/2) silty clay loam; grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B21—17 to 21 inches; dark grayish brown (10YR 4/2) silty clay loam, high in sand; few fine faint dark yellowish brown (10YR 4/4) mottles; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

IIB22—21 to 27 inches; yellowish brown (10YR 5/6) loam; few fine faint grayish brown (10YR 5/2) mottles; few grayish brown (10YR 5/2) coatings on faces of prisms and peds; weak medium prismatic structure parting to weak fine subangular blocky; friable; pebble band in upper part; few small pebbles throughout; slightly acid; clear smooth boundary.

IIB23—27 to 35 inches; yellowish brown (10YR 5/6) loam; few fine distinct grayish brown (10YR 5/2) mottles; few grayish brown (2.5Y 5/2) coatings on faces of prisms and peds; weak medium prismatic structure parting to weak fine subangular blocky; firm; few small pebbles; slightly acid; clear smooth boundary.

IIB3—35 to 43 inches; yellowish brown (10YR 5/6) loam; few grayish brown (2.5Y 5/2) coatings on faces of prisms and peds; weak medium prismatic structure parting to weak fine subangular blocky; firm; few small pebbles; neutral; clear wavy boundary.

IIC—43 to 60 inches; mottled light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) loam; massive; firm; few small pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates are commonly the same and range from 42 to 60 inches. Thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon is black (10YR 2/1) in the upper part and black (10YR 2/1) to very dark grayish brown (10YR 3/2) in the lower part. The A horizon ranges from silty clay loam to loam and clay loam 12 to 18 inches thick.

The B horizon is dark grayish brown (10YR 4/2 and 2.5Y 4/2). It does not have mottles or it can have common mottles high in chroma. The B horizon is loam, silty clay loam high in sand, and clay loam. The IIB and IIC horizons typically are loam but range to clay loam and sandy clay loam.

The Ap horizon ranges from neutral to medium acid. The lower part of the A horizon and the B horizon are medium acid or strongly acid. The IIB horizon is medium acid or slightly acid. The IIC horizon is neutral or mildly alkaline.

Riceville series

The Riceville series consists of somewhat poorly drained soils on slightly convex and slightly concave, lower side slopes on uplands. These soils formed in 16 to 26 inches of loamy sediment and the underlying glacial till. Permeability is moderately slow. Native

vegetation was prairie grasses and trees. Slope ranges from 1 to 4 percent.

Riceville soils are similar to Schley soils and are commonly adjacent to Clyde, Lourdes, and Schley soils. Schley soils are deeper to glacial till than Riceville soils. Clyde soils are poorly drained. Lourdes soils have a browner B horizon and are better drained. Clyde and Schley soils are commonly downslope from Riceville soils. Lourdes soils are on convex slopes above Riceville soils.

Typical pedon of Riceville loam, 1 to 4 percent slopes, in a cultivated area; 2,120 feet west and 860 feet south of the northeast corner of sec. 8, T. 93 N., R. 17 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; very strongly acid; clear wavy boundary.

B1—11 to 18 inches; mottled yellowish brown (10YR 5/6) and dark grayish brown (10YR 4/2) clay loam; weak fine subangular blocky structure; friable; few yellowish red (5YR 5/6) iron oxide concretions; strongly acid; clear smooth boundary.

IIB2t—18 to 31 inches; mottled yellowish brown (10YR 5/6) and gray (5Y 5/1) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; discontinuous very dark gray (10YR 3/1) clay films on prisms and peds and in pores and root channels; pebble band at top of horizon; few small pebbles throughout; medium acid; gradual smooth boundary.

IIB3t—31 to 46 inches; mottled light olive brown (2.5Y 5/4) and gray (5Y 5/1) clay loam; weak medium prismatic structure; very firm; black (10YR 2/1) clay films fill many pores and root channels; few small pebbles; neutral; clear wavy boundary.

IIC—46 to 60 inches; mottled light olive brown (2.5Y 5/4) and gray (5Y 5/1) light clay loam; massive; very firm; black (10YR 2/1) clay films in some pores; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum is commonly the same as the depth to carbonates and typically ranges from 40 to 60 inches. Thickness of material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon typically is dark grayish brown (10YR 4/2) but ranges from very dark grayish brown (10YR 3/2) to grayish brown (2.5Y 5/2). It is 2 to 5 inches thick.

The average clay content of the IIB horizon ranges from 30 to 35 percent but the subhorizons of some pedons are as much as 38 percent clay. A few pedons have coatings of gray (5Y 5/1 or 6/1) on the faces of prisms and peds.

The A1 or Ap horizon is neutral to medium acid. The A2 and B1 horizons are strongly acid or very strongly acid, and the IIB horizon is medium acid or strongly acid. The IIB3 and IIC horizons are neutral or mildly alkaline.

Rockton series

The Rockton series consists of well drained, moderately permeable soils on uplands and high stream benches. These soils formed in 20 to 40 inches of loamy sediment and a thin, discontinuous, underlying layer of clayey, limestone residuum. Underlying this material is limestone bedrock. Native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Rockton soils are commonly adjacent to Kenyon and Sogn soils. Kenyon soils formed in glacial till and are upslope from Rockton soils. Sogn soils are more shallow to limestone bedrock than Rockton soils and are in more sloping areas below Rockton soils.

Typical pedon of Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes, in a cultivated area; 2,600 feet west and 800 feet north of the southeast corner of sec. 34, T. 93 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; slightly acid; clear wavy boundary.

B1—13 to 17 inches; dark brown (10YR 3/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

IIB21t—17 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; pebble band in upper part; few small pebbles throughout; slightly acid; gradual smooth boundary.

IIB22t—26 to 33 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; nearly continuous brown (10YR 4/3) clay films on faces of peds; few small pebbles; medium acid; clear wavy boundary.

IIIB23t—33 to 38 inches; brown (10YR 5/3) silty clay; moderate fine angular blocky structure; very firm; nearly continuous dark grayish brown (2.5Y 4/2) clay films on faces of peds; few yellowish red (5YR 5/6) iron oxide concretions; neutral; abrupt wavy boundary.

IIIR—38 inches; hard shattered limestone overlying hard level-bedded limestone bedrock.

The thickness of the solum and depth to limestone range from 20 to 40 inches. Thickness of the mollic epipedon ranges from 10 to 18 inches.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The B and IIB horizons range from brown (10YR 4/3) to yellowish brown (10YR 5/4). The horizon that formed in clayey residuum ranges from brown (10YR 4/3) to brown (7.5YR 5/4) and reddish brown (5YR 5/4).

The A horizon typically is loam but ranges to silt loam high in sand. The B1 horizon typically is loam or silt loam high in sand. The B2, B3, and IIB horizons formed in glacial till and are loam, sandy clay loam, and clay loam. The IIIB horizon typically is clay or silty clay 0 to 6 inches thick.

The shattered upper part of the limestone ranges from 2 to 5 feet thick and contains 5 to 10 percent loamy materials. In places, bits of clayey residuum are on the slabs of limestone. As slope increases, the thickness of the shattered limestone generally decreases.

The reaction in the solum ranges from neutral to medium acid.

In map unit 214C2, the dark colored surface soil is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Saude series

The Saude series consists of well drained soils on stream benches and, in a few places, on uplands. These soils formed in 20 to 30 inches of loamy sediment and the underlying loamy sand and sand that contains some gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Native vegetation was prairie grasses. Slope ranges from 0 to 18 percent.

Saude soils are similar to Bolan soils and are commonly adjacent to Burkhardt, Flagler, Lawler, and Wapsie soils. Bolan soils are deeper to sand than Saude soils and do not have gravel. Burkhardt soils are coarser textured throughout. Flagler soils have more sand in the upper part of the solum than Saude soils. Lawler soils have a grayer B horizon and are not so well drained. Wapsie soils have a thinner, lighter A horizon. Burkhardt, Flagler, and Wapsie soils are on landscape positions similar to those of Saude soils. Lawler soils are on lower lying positions.

Typical pedon of Saude loam, 0 to 2 percent slopes, in a cultivated field; 1,270 feet west and 100 feet south of the northeast corner of sec. 12, T. 93 N., R. 16 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 12 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

B1—12 to 17 inches; brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2—17 to 25 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

IIB3—25 to 31 inches; yellowish brown (10YR 5/6) loamy sand; very weak fine subangular blocky structure; loose; medium acid; gradual smooth boundary.

IIC1—31 to 41 inches; yellowish brown (10YR 5/8) sand; single grain; loose; few small pebbles; slightly acid; gradual smooth boundary.

IIC2—41 to 60 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few small pebbles; slightly acid.

The thickness of the solum ranges from 24 to 44 inches and depth to loamy sand or sand ranges from 20 to 30 inches. Thickness of the mollic epipedon ranges from 11 to 16 inches.

The A horizon ranges from black (10YR 2/1) to very dark brown (10YR 2/2) in the Ap or A1 horizon and very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) in the A3 horizon. The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). Some pedons have sandy loam B3 horizons 2 to 5 inches thick. In some upland areas, the IIC horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/8).

The A and B horizons range from neutral to medium acid. The IIB and IIC horizons are slightly acid to strongly acid.

In map units 241C2 and 241E2, the Saude soil has a dark surface soil that is thinner than required for a mollic epipedon, but this difference does not alter the usefulness or behavior of this soil.

Schley series

The Schley series consists of somewhat poorly drained, moderately permeable soils on lower side

slopes adjacent to drainageways on uplands. These soils formed in about 30 to 45 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses and trees. Slope ranges from 1 to 4 percent.

Schley soils are similar to Riceville soils and are commonly adjacent to Clyde, Floyd, and Riceville soils. Riceville soils are less stratified than Schley soils and are shallower to glacial till. Clyde and Floyd soils have a thicker, dark colored A horizon and are less acid throughout the solum. Clyde and Floyd soils are at a slightly lower elevation downslope from Schley soils, and Riceville soils are at a higher elevation upslope.

Typical pedon of Schley silt loam, 1 to 4 percent slopes, in a cultivated field; 2,190 feet west and 335 feet north of the southeast corner of sec. 11, T. 93 N., R. 18 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam, high in sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; clear smooth boundary.

A2—6 to 11 inches; dark grayish brown (10YR 4/2) silt loam, high in sand, light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; few dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; strongly acid; clear wavy boundary.

B21—11 to 17 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) and few fine faint strong brown (7.5YR 5/6) mottles; discontinuous grayish brown (10YR 5/2) coatings on faces of peds; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B22t—17 to 24 inches; yellowish brown (10YR 5/6) loam; common fine distinct grayish brown (2.5Y 5/2) mottles; few light brownish gray (2.5Y 6/2) coatings on faces of peds; weak medium subangular blocky structure; friable; thin discontinuous clay films on faces and in pores; few small pebbles; medium acid; gradual smooth boundary.

B31t—24 to 33 inches; yellowish brown (10YR 5/6) sandy loam; few fine faint brown (10YR 5/3) mottles; light brownish gray (2.5Y 6/2) fine sand coatings on faces of prisms; white (2.5Y 8/2) when dry; moderate fine prismatic structure; very friable; sand grains are coated and bridged with clay; few small pebbles; slightly acid; gradual smooth boundary.

IIB32—33 to 42 inches; strong brown (7.5YR 5/8) sandy clay loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure; friable; few brownish yellow (10YR 6/8) and dark reddish brown (2.5YR 3/4) iron oxide concretions; slightly acid; clear smooth boundary.

IIC—42 to 80 inches; mottled strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) stratified loam and sandy clay loam; massive; firm; few dark reddish brown (5YR 2/2) manganese oxide concretions; neutral.

The thickness of the solum ranges from 40 to 60 inches. The depth to carbonates typically is 55 to 80 inches. Thickness of material that has mollic colors ranges from 6 to 10 inches.

The Ap horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1) and very dark brown (10YR 2/2). The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3) and has few to many grayish mottles. It is 0 to 10 inches thick. The B horizon ranges from dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/6).

The A horizon is silt loam with noticeable amounts of sand or loam. The B horizon ranges from loam to sandy loam and sandy clay loam. The IIB horizon is loam, clay loam, or sandy clay loam.

Some pedons have 2- to 5-inch strata of loamy sand at the place of contact of the surficial loamy sediment and the underlying glacial till. The Ap horizon ranges from neutral to medium acid. The A2, B, and IIB2 horizons range from slightly acid to very strongly acid, and the IIB3 horizon is slightly acid or medium acid. The IIC horizon ranges from slightly acid to mildly alkaline.

Shandep series

The Shandep series consists of very poorly drained soils in depressional areas on stream benches. These soils formed in 40 to 55 inches of loamy alluvial sediment overlying sand and gravelly sand. Native vegetation was prairie grasses. Slope is 0 to 1 percent.

Shandep soils are similar to Coland and Spillville soils and are commonly adjacent to Marshan soils. Coland and Spillville soils have less sand in the lower part of the solum than Shandep soils. Marshan soils have coarse textured substrata above 40 inches and are slightly higher on the landscape.

Typical pedon of Shandep clay loam, 0 to 1 percent slopes, in an uncultivated field; 2,340 feet west and 100 feet north of the southeast corner of sec. 23, T. 91 N., R. 17 W.

A11—0 to 19 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A12—19 to 27 inches; black (5Y 2/1) light clay loam, dark gray (5Y 4/1) dry; moderate fine granular structure; friable; very few small pebbles; neutral; clear wavy boundary.

A3—27 to 36 inches; very dark gray (5Y 3/1) light clay loam, gray (5Y 5/1) dry; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; very few small pebbles; neutral; clear wavy boundary.

B2g—36 to 42 inches; dark gray (5Y 4/1) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; common black (5Y 2/1) manganese oxide concretions; few small pebbles; neutral; gradual smooth boundary.

B3g—42 to 48 inches; dark gray (5Y 4/1) heavy sandy loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few small pebbles; mildly alkaline; clear smooth boundary.

IICg—48 to 60 inches; gray (5Y 5/1) medium and coarse sand; single grain; loose; few small pebbles; mildly alkaline.

The thickness of the solum and depth to sand or gravelly sand range from 40 to 55 inches. Thickness of the mollic epipedon ranges from 26 to 36 inches.

The A1 horizon is black (N 2/0 or 5Y 2/1). The B horizon is dark gray (N 4/0 or 5Y 4/1) or gray (N 5/0 or 5Y 5/1). The B3 horizon is the same color as that of the B2 horizon.

The A horizon typically is clay loam or loam but ranges to silty clay loam high in sand. The B2 horizon is loam, clay loam, or sandy clay loam and in some pedons is silty clay loam high in sand. The B3 horizon is loam or sandy loam. The IIC horizon ranges from gravelly sand to loamy sand.

The A and B2 horizons are neutral or slightly acid. The B3 and IIC horizons range from slightly acid to mildly alkaline.

Sogn series

The Sogn series consists of somewhat excessively drained, moderately permeable soils on uplands and high stream benches. These soils formed in 4 to 20 inches of loamy sediment. Underlying this material is limestone bedrock. Native vegetation was prairie grasses. Slope ranges from 2 to 30 percent.

Sogn soils in Butler County differ from Sogn soils in other areas because they have a more moist climate and map unit 412F has steeper slopes than described in the range for the series. These differences do not alter the use or behavior of these soils.

Sogn soils are commonly adjacent to Rockton and Winneshiek soils. Rockton and Winneshiek soils formed in 20 to 40 inches of loamy sediment over limestone bedrock and are in sloping areas above Sogn soils.

Typical pedon of Sogn loam, 9 to 30 percent slopes, in an uncultivated field; 1,540 feet north and 1,120 feet east of the southwest corner of sec. 10, T. 92 N., R. 15 W.

A11—0 to 6 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; friable; few small limestone fragments; neutral; clear wavy boundary.

A12—6 to 11 inches; very dark grayish brown (10YR 3/2) channery clay loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate fine subangular blocky structure; friable; about 30 percent 1/2 inch to 5 inches hard limestone fragments; mildly alkaline; clear irregular boundary.

IIR—11 inches; level-bedded hard fragmented limestone bedrock containing about 5 percent loamy material. Nonfragmented level-bedded limestone bedrock below a depth of about 30 inches.

The thickness of the solum and depth to limestone typically are 6 to 16 inches but range from 4 to 20 inches. Thickness of the mollic epipedon ranges from 4 to 12 inches.

The A1 or Ap horizon ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3). The A3 horizon is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2).

The A horizon is dominantly loam but ranges to clay loam, silt loam high in sand, and sandy loam. In some pedons, thin, discontinuous horizons of clayey residuum are in the lower part of the solum. Many pedons contain fragments of limestone throughout the solum.

The solum ranges from slightly acid to mildly alkaline.

The fragmented upper part of the limestone bedrock ranges from 0 to 4 feet in thickness and contains 5 to 10 percent loamy materials. In a few places, bits of clayey residuum cling to the slabs of limestone. As slope increases, the thickness of the fragmented rock typically decreases.

Sparta series

The Sparta series consists of excessively drained soils on uplands and stream benches. These soils formed in eolian sand and sandy alluvium that has been reworked by wind. Permeability is moderately rapid in the upper part of the soil and rapid in the lower part. Native vegetation was prairie grasses and trees. Slope ranges from 1 to 14 percent.

Sparta soils are similar to Dickinson soils and are commonly adjacent to Chelsea, Dickinson, Hoopeston, Lamont, and Olin soils. Dickinson, Hoopeston, Lamont, and Olin soils contain less sand in the upper part of the solum than Sparta soils. Chelsea soils have thinner, lighter colored horizons and are on slightly higher landscape positions. Dickinson, Lamont, and Olin soils

are on landscape positions similar to those of Sparta soils. Hoopeston soils are in lower lying areas.

Typical pedon of Sparta loamy fine sand, 5 to 9 percent slopes, in a cultivated field; 2,140 feet east and 115 feet south of the northwest corner of sec. 12, T. 91 N., R. 15 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; very weak fine granular structure; very friable; neutral; clear smooth boundary.

A12—10 to 17 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; very weak fine granular structure; very friable; slightly acid; clear smooth boundary.

B2—17 to 36 inches; brown (7.5YR 4/4) loamy fine sand; very weak fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C—36 to 60 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) loamy sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. Thickness of the mollic epipedon ranges from 10 to 24 inches.

The A horizon ranges from very dark brown (10YR 2/2) to dark brown (10YR 3/3). The B horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6).

The solum typically is loamy fine sand but ranges to fine sand and loamy sand. The B horizon typically is loamy fine sand but ranges to loamy sand, sand, and fine sand.

The A horizon ranges from neutral to medium acid, and the B and C horizons are medium acid or slightly acid.

Spillville series

The Spillville series consists of moderately well drained and somewhat poorly drained, moderately permeable soils on bottom lands and in upland drainageways. These soils formed in loamy alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Spillville soils are similar to Terril soils and are commonly adjacent to Coland soils. Terril soils have a thinner A horizon. Coland soils contain more clay throughout the solum and have grayer colors in the substratum than Spillville soils. They are on landscape positions similar to those of Spillville soils.

Typical pedon of Spillville loam, 0 to 2 percent slopes, in pasture; 1,820 feet west and 50 feet north of the southeast corner of sec. 17, T. 93 N., R. 15 W.

A11—0 to 21 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A12—21 to 30 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; very few small pebbles; slightly acid; clear smooth boundary.

A13—30 to 55 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

C—55 to 68 inches; very dark grayish brown (10YR 3/2) loam; few fine distinct brown (10YR 4/3) mottles; few small pebbles; massive; friable; slightly acid.

The thickness of the solum ranges from 40 to 56 inches. Thickness of the material that has mollic colors is more than 50 inches.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2), but in some pedons it is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) below a depth of 40 inches.

The upper 3 feet of the soil is commonly loam or silt loam high in sand. Below this, the soil is commonly loam but ranges to sandy loam and clay loam. The C horizon typically is loam but ranges to sandy loam and clay loam.

The soil is commonly neutral or slightly acid throughout, but subhorizons in some pedons are medium acid.

Tama series

The Tama series consists of well drained, moderately permeable soils on uplands. These soils formed in loess. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Tama soils are commonly adjacent to Dinsdale, Garwin, and Muscatine soils. Dinsdale soils formed in 20 to 40 inches of loess over glacial till and are on landscape positions similar to those of Tama soils. Garwin soils are poorly drained. They have a grayer B horizon than Tama soils and are less sloping. Muscatine soils are somewhat poorly drained and are less sloping.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, in a cultivated field; 1,725 feet east and 86 feet south of the northwest corner of sec. 7, T. 90 N., R. 17 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A3—6 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

B1—13 to 19 inches; brown (10YR 4/3) silty clay loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; few light gray (10YR 7/1) silt coats when dry; medium acid; gradual smooth boundary.

B2—19 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; discontinuous brown (10YR 4/3) and a few dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; few light gray (10YR 7/1) silt coats on peds when dry; medium acid; gradual smooth boundary.
B3—35 to 56 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; slight increase in sand below 48 inches; few light gray (10YR 7/1) silt coats on peds when dry; slightly acid; gradual smooth boundary.
C1—56 to 65 inches; yellowish brown (10YR 5/6) sandy loam; massive; very friable; neutral; gradual smooth boundary.
C2—65 to 80 inches; yellowish brown (10YR 5/6) silt loam; massive; friable; neutral.

The thickness of the solum ranges from 40 to more than 60 inches. Depth to carbonates ranges from 50 to more than 80 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The A3 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B horizon is brown (10YR 4/3) and dark yellowish brown (10YR 4/4). Low chroma mottles are at a depth of more than 40 inches.

The A horizon typically is silt loam but ranges to silty clay loam. The B3 horizon is silt loam and silty clay loam.

The A horizon ranges from medium acid to neutral, and the B horizon is slightly acid or medium acid. The C horizon ranges from medium acid to neutral.

Terril series

The Terril series consists of moderately well drained, moderately permeable soils on foot slopes and alluvial fans on uplands. These soils formed in loamy, local alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Terril soils are similar to Spillville soils and are commonly adjacent to Coland and Spillville soils. Spillville soils have a mollic epipedon more than 40 inches thick. Coland soils are poorly drained. Both of these soils are at a lower elevation and are downslope from Terril soils.

Typical pedon of Terril loam, 2 to 5 percent slopes, in a cultivated field; 1,400 feet south and 200 feet west of the center of sec. 11, T. 93 N., R. 17 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak medium subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.
A12—8 to 17 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.
A13—17 to 24 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; discontinuous black (10YR 2/1) coatings on faces of peds; weak medium subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.
A3—24 to 32 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.
B1—32 to 37 inches; dark brown (10YR 3/3) clay loam; discontinuous very dark brown (10YR 2/2) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; medium acid; gradual smooth boundary.
B2—37 to 44 inches; dark yellowish brown (10YR 4/4) loam, discontinuous dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.
B3—44 to 60 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; medium acid.

The thickness of the solum ranges from about 36 to 60 inches. Thickness of the mollic epipedon ranges from 24 to 40 inches.

The A1 horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2). It is 24 to 38 inches thick. The surface horizon in some areas that have recent overwash is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B1 horizon is dark brown (10YR 3/3) or brown (10YR 4/3) with darker coatings on peds. The B2 and B3 horizons range from brown (10YR 4/3) to yellowish brown (10YR 5/6). Some pedons have faint mottles in the lower part of the B horizon or in the C horizon.

Typically, the A horizon is loam but ranges to silt loam high in sand. The B horizon is commonly loam but ranges to clay loam. The C horizon, where present, is loam or clay loam. The IIC horizon is sand or loamy sand and is below a depth of 5 or 6 feet in most places.

The soil ranges from medium acid to neutral throughout.

Thorp series

The Thorp series consists of poorly drained soils on stream benches. These soils formed in 45 to 75 inches of silty alluvial sediment. Permeability is moderately slow.

Native vegetation was prairie grasses. Slope is 0 to 1 percent.

The Thorp soils in Butler County differ from Thorp soils in other areas because they do not have a mollic epipedon. This difference does not alter the use or behavior of these soils.

Thorp soils are commonly adjacent to Marshan and Raddle soils. Marshan soils have a thicker A horizon and have more sand and less silt in the A and B horizons than Thorp soils. They are at a slightly higher elevation than Thorp soils. Raddle soils are well drained and are more sloping.

Typical pedon of Thorp silt loam, 0 to 1 percent slopes, in a cultivated field; 2,525 feet west and 450 feet north of the southeast corner of sec. 4, T. 91 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 21 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; light gray (10YR 7/1) silt coatings dry; moderate medium platy structure; friable; slightly acid; clear wavy boundary.

B21g—21 to 28 inches; gray (5Y 5/1) silty clay loam; few distinct strong brown (7.5YR 5/6) mottles; light gray (10YR 7/1) silt coatings dry; moderate medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B22tg—28 to 44 inches; gray (5Y 5/1) silty clay loam; common fine distinct olive (5Y 5/4) and yellowish red (5YR 5/6) mottles; nearly continuous gray (5Y 5/1) coatings on faces of prisms; moderate fine prismatic structure parting to weak medium subangular blocky; friable; few very dark gray (10YR 3/1) clay films on prism faces and in pores and root channels; medium acid; gradual smooth boundary.

Cg—44 to 72 inches; olive gray (5Y 5/2) silt loam; many medium distinct olive (5Y 5/6) mottles; massive; friable; slightly acid.

The thickness of the solum ranges from 40 to 60 inches.

The Ap or A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1). It is 6 to 10 inches thick. The A2 horizon typically is dark gray (10YR 4/1) or gray (10YR 5/1) but ranges to dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2). The B2 horizon typically ranges from dark gray (10YR 4/1) to olive gray (5Y 5/2) and has few to common, distinct mottles.

The B2 horizon ranges from silt loam to silty clay loam. The C horizon typically is silt loam but ranges to include IIC horizons that are sandy loam, loamy sand, and sand.

The A1 or Ap horizon is slightly acid or neutral. The A2 horizon is slightly acid or medium acid, and the B horizon is medium acid or strongly acid. The C and IIC horizons range from neutral to medium acid.

Tripoli series

The Tripoli series consists of poorly drained, moderately permeable soils on broad ridge crests and at the heads of drainageways on uplands. These soils formed in 18 to 28 inches of loamy sediment and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Tripoli soils are similar to Clyde soils and are commonly adjacent to Kenyon and Readlyn soils. Clyde soils are deeper to firm glacial till and to carbonates than Tripoli soils. Kenyon and Readlyn soils are better drained and have a browner B horizon than Tripoli soils. Kenyon and Readlyn soils are more sloping and are downslope from Tripoli soils.

Typical pedon of Tripoli silty clay loam, 0 to 2 percent slopes, in a pasture; 1,120 feet west and 50 feet south of the northeast corner of sec. 25, T. 92 N., R. 17 W.

A11—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A12—9 to 14 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A3—14 to 18 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; common fine distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

B1g—18 to 24 inches; grayish brown (2.5Y 5/2) silty clay loam, high in sand; few fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

IIB2—24 to 34 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; pebble band in upper part; few small pebbles throughout; neutral; gradual smooth boundary.

IIB3—34 to 40 inches; yellowish brown (10YR 5/6) loam; many fine distinct light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few small pebbles; neutral; clear wavy boundary.

IIC—40 to 60 inches; yellowish brown (10YR 5/6) loam; many fine distinct light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few small pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 36 to 48 inches. Thickness of the mollic epipedon ranges from 14 to 24 inches.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1). The A3 horizon is very dark gray (10YR 3/1). The B1 horizon ranges from dark grayish brown (2.5Y 4/2) with some high value and low chroma mottles to gray (5Y 5/1).

The upper 18 inches of the A horizon ranges from silty clay loam to clay loam. Below a depth of 18 inches, the A horizon ranges from clay loam to silty clay loam high in sand. The B1 horizon ranges from loam to silty clay loam high in sand. The IIB and IIC horizons are commonly loam but range to clay loam and sandy clay loam.

The A horizon is neutral, and the B, IIB, and IIC horizons are neutral or mildly alkaline.

Wapsie series

The Wapsie series consists of well drained soils on stream benches and, in a few places, on uplands. These soils formed in 20 to 30 inches of loamy sediment and the underlying loamy sand and sand that contains some gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Wapsie soils are commonly adjacent to the Saude and Waukee soils. Saude and Waukee soils have a thicker dark colored surface horizon than Wapsie soils. They are on landscape positions similar to those of Wapsie soils.

Typical pedon of Wapsie loam, 2 to 5 percent slopes, in a cultivated field; 1,900 feet west and 1,370 feet south of the northeast corner of sec. 29, T. 92 N., R. 15 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; neutral; clear smooth boundary.

B1—7 to 13 inches; brown (10YR 4/3) loam; few dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear wavy boundary.

B21t—13 to 23 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; clear wavy boundary.

B22t—23 to 28 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; medium acid; abrupt smooth boundary.

IIB3t—28 to 40 inches; yellowish brown (10YR 5/6) loamy sand; very weak coarse subangular blocky structure; very friable; few small pebbles; medium acid; clear smooth boundary.

IIC1—40 to 44 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) loamy sand; single grain; loose; few small pebbles; slightly acid; clear smooth boundary.

IIC2—44 to 60 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few small pebbles; slightly acid.

The thickness of the solum ranges from 24 to 44 inches. Depth to loamy sand and sand ranges from 20 to 30 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon, where present, is dark grayish brown (10YR 4/2) or brown (10YR 5/3). It is 2 to 6 inches thick. The B2 horizon ranges from brown (10YR 4/3 and 7.5YR 4/4) to dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8).

The A and B2 horizons typically are loam or sandy clay loam. Some pedons have a sandy loam B3 horizon 2 to 5 inches thick, and some pedons do not have a IIB3 horizon.

The Ap or A1 horizon ranges from neutral to medium acid, and the B horizon is medium acid or strongly acid. The IIB and IIC horizons range from neutral to strongly acid.

Waubeek series

The Waubeek series consists of well drained, moderately permeable soils on ridge crests and side slopes on uplands. These soils formed in 20 to 40 inches of loess and the underlying glacial till. Native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Waubeek soils are similar to Mt. Carroll soils and are commonly adjacent to Bassett and Klinger soils. Mt. Carroll soils have less sand in the lower part of the B horizon and in the C horizon than Waubeek soils. Bassett soils formed entirely in loamy glacial till. Klinger soils have a thicker A horizon and do not have an A2 horizon. They are somewhat poorly drained and are less sloping than Waubeek soils. Bassett soils are on landscape positions similar to those of Waubeek soils.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes, in a cultivated field; 2,190 feet south and 50 feet east of the northwest corner of sec. 13, T. 90 N., R. 16 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—8 to 14 inches; brown (10YR 4/3) silty clay loam; discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; few white (10YR 8/1) silt coatings dry; moderate fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B21t—14 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam; discontinuous brown (10YR 4/3) coatings on faces of peds; few white (10YR 8/1) silt coatings dry; moderate fine subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; medium acid; gradual smooth boundary.

B22t—23 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few white (10YR 8/1) silt coatings on peds dry; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; clear smooth boundary.

IIB31—32 to 38 inches; yellowish brown (10YR 5/6) loamy sand; weak coarse subangular blocky structure; very friable; pebble band near top of horizon; few small pebbles throughout horizon; medium acid; clear smooth boundary.

IIB32—38 to 47 inches; yellowish brown (10YR 5/6) clay loam; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few very dark gray (10YR 3/1) manganese oxide concretions; few pebbles; slightly acid; clear wavy boundary.

IIB33t—47 to 56 inches; brown (7.5YR 4/4) clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate fine prismatic structure; firm; thin discontinuous brown (7.5YR 4/4) clay films on prism faces; few small pebbles; neutral; clear wavy boundary.

IIC—56 to 72 inches; strong brown (7.5YR 5/6) clay loam; common fine distinct gray (5Y 5/1) mottles; massive; firm; few small dark reddish brown (5YR 2/2) manganese oxide concretions; few small pebbles; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 42 to 60 inches and depth to carbonates ranges from about 45 to 70 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). Some pedons have an A2 horizon of dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3) silt loam 2 to 6 inches thick. The B horizon is brown (10YR 4/3 or 5/3) or dark yellowish brown (10YR 4/4). The IIB horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6). It is loam, clay loam, or sandy clay loam and may have subhorizons of loamy sand to as much as 6 inches thick.

The Ap horizon ranges from neutral to medium acid, and the B horizon is medium acid or strongly acid in the most acid part. The IIB horizon is slightly acid or medium acid. The IIC horizon ranges from slightly acid to mildly alkaline.

Waukee series

The Waukee series consists of well drained soils on stream benches and in a few places on uplands. These soils formed in about 30 to 40 inches of loamy sediment and the underlying loamy sand and sand that contains some gravel. Permeability is moderate in the solum and very rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

The Waukee soils are commonly adjacent to Lawler, Marshan, Wapsie, and Waukegan soils. Lawler and Marshan soils have a grayer B horizon and are more poorly drained than Waukee soils. Wapsie soils have a thinner A horizon. Waukegan soils have less sand in the A horizon and upper part of the B horizon. Lawler and Marshan soils are on lower lying positions than Waukee soils. Wapsie and Waukegan soils are on landscape positions similar to those of Waukee soils.

Typical pedon of Waukee loam, 0 to 2 percent slopes, in a cultivated field; 130 feet north and 50 feet west of the southeast corner of sec. 3, T. 93 N., R. 16 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak very fine granular structure; friable; medium acid; gradual smooth boundary.

B1—14 to 20 inches; dark brown (10YR 3/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine subangular blocky structure; medium acid; clear smooth boundary.

B21—20 to 27 inches; brown (10YR 4/3) loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B22—27 to 38 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

IIC1—38 to 60 inches; yellowish brown (10YR 5/6) loamy coarse sand; single grain; loose; few small pebbles; slightly acid.

The thickness of the solum ranges from 30 to 48 inches, and the depth to loamy sand and sand ranges from 30 to 40 inches. Thickness of the mollic epipedon ranges from 12 to 20 inches.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The A3 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B2 horizon ranges from brown (10YR 4/3) to yellowish

brown (10YR 5/6). Some pedons have a B3 horizon of sandy loam 2 to 5 inches thick or a IIB3 horizon of coarse loamy sand. The IIC horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) in some of the upland areas.

The A horizon ranges from neutral to medium acid. The B horizon is medium acid, and the IIC horizon is slightly acid or medium acid.

Waukegan series

The Waukegan series consists of well drained soils on stream benches and in a few places on uplands. These soils formed in 24 to 40 inches of silty sediment overlying loamy sand and sand that contains some gravel. Permeability is moderate in the solum and rapid in the substratum. Native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Waukegan soils are commonly adjacent to Lawler and Waukee soils. Lawler soils are somewhat poorly drained. Lawler and Waukee soils have more sand throughout the solum than Waukegan soils. Lawler soils are at a slightly lower elevation than Waukegan soils, and Waukee soils are on landscape positions similar to those of Waukegan soils.

Typical pedon of Waukegan silt loam, 0 to 2 percent slopes, in a cultivated area; 1,580 feet west and 80 feet north of the center of sec. 7, T. 92 N., R. 16 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium granular structure; friable; neutral; clear smooth bondary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak medium subangular blocky structure parting to moderate fine granular; friable; slightly acid; clear smooth boundary.

A3—11 to 16 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear wavy boundary.

B1—16 to 25 inches; brown (10YR 4/3) silt loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate very fine and fine subangular blocky structure; friable; medium acid; clear wavy boundary.

B2—25 to 33 inches; yellowish brown (10YR 5/4) silty clay loam, discontinuous dark yellowish brown (10YR 3/4) coatings on faces of peds; moderate fine subangular blocky structure; friable; dark yellowish brown (10YR 3/4) sandy loam between 31 to 33 inches; slightly acid; clear smooth boundary.

IIC1—33 to 46 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; 15 percent very fine gravel; slightly acid; gradual smooth boundary.

IIC2—46 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; medium acid.

Thickness of the solum ranges from 30 to 48 inches, and the depth to loamy sand and sand ranges from 24 to 40 inches. Thickness of the mollic epipedon ranges from 12 to 20 inches.

The A1 or Ap horizon is black (10YR 2/1) or very dark grayish brown (10YR 3/2). The A3 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4).

The B horizon is silt loam or silty clay loam. The IIC horizon is dominantly sand or loamy sand that is 10 to 25 percent gravel.

The A horizon ranges from neutral to medium acid, and the B, IIB, and IIC horizons are slightly acid or medium acid.

Winneshiek series

The Winneshiek series consists of well drained, moderately permeable soils on uplands and high stream benches. These soils formed in 20 to 36 inches of loamy sediment and the thin underlying clayey limestone residuum. Underlying this material is limestone bedrock. Native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Winneshiek soils are commonly adjacent to Bassett and Sogn soils. Bassett soils formed in loamy glacial till and do not have limestone bedrock above a depth of 60 inches. Sogn soils have 5 to 20 inches of loamy sediment overlying limestone. Bassett soils are on ridges and side slopes above Winneshiek soils, and Sogn soils are downslope from Winneshiek soils.

Typical pedon of Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes, in a cultivated field; 2,040 feet west and 1,910 feet south of the northeast corner of sec. 8, T. 92 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

B1—7 to 10 inches; brown (10YR 4/3) loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; neutral; clear wavy boundary.

B21t—10 to 21 inches; brown (10YR 4/3) loam; few dark brown (10YR 3/3) coatings on faces of peds; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; thin discontinuous very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) clay films on ped faces and in pores; neutral; clear smooth boundary.

IIB22t—21 to 30 inches; strong brown (7.5YR 5/6) and brown (10YR 5/3) clay loam; moderate medium prismatic structure; very firm; thin discontinuous dark brown (10YR 3/3) clay films on prism faces and in pores; medium acid; clear wavy boundary.

IIB23t—30 to 35 inches; strong brown (7.5YR 5/6) clay; moderate fine prismatic structure; extremely firm; thin discontinuous very dark grayish brown (10YR 3/2) clay films in pores; medium acid; abrupt wavy boundary.

IIR—35 inches; hard shattered limestone overlying hard level-bedded limestone bedrock.

The thickness of the solum and depth to limestone range from 20 to 40 inches. Thickness of the material that has mollic colors ranges from 6 to 10 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. Some pedons have an A2 horizon of brown (10YR 4/3) or dark grayish brown (10YR 4/2) loam 2 to 6 inches thick. The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). The B1 horizon typically is loam, and the B2 and B3 horizons are loam, sandy clay loam, and clay loam. The horizon formed in clayey residuum ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6) and yellowish red (5YR 5/8). It typically is clay or silty clay 1 inch to 5 inches thick.

The shattered upper part of the limestone bedrock ranges from 2 to 5 feet thick and has 5 to 10 percent loamy materials. As slope increases, the thickness of the shattered limestone generally decreases.

The solum ranges from neutral to medium acid.

Worthen series

The Worthen series consists of well drained, moderately permeable soils on foot slopes and alluvial fans on uplands. These soils formed in silty, local alluvial sediment. Native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Worthen soils are similar to Ely soils and are commonly adjacent to Mt. Carroll soils. Ely soils are somewhat poorly drained and have more clay in the solum than Worthen soils. Mt. Carroll soils do not have a mollic epipedon and are on more sloping positions above Worthen soils.

Typical pedon of Worthen silt loam, 2 to 5 percent slopes, in a cultivated field; 1,280 feet south and 260 feet east of the northwest corner of sec. 29, T. 90 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 19 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; neutral; gradual smooth boundary.

B1—19 to 30 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B2—30 to 43 inches; brown (10YR 4/3) silt loam; discontinuous dark brown (10YR 3/3) coatings on faces of peds and in root channels; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B3—43 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; few brown (10YR 4/3) coatings on faces of peds and very dark grayish brown (10YR 3/2) coatings in root channels; weak coarse subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—54 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint brown (10YR 5/3) mottles; neutral; gradual smooth boundary.

The thickness of the solum ranges from about 35 to 60 inches. Thickness of the mollic epipedon ranges from 24 to 40 inches.

The A horizon typically is very dark brown (10YR 2/2) but ranges to black (10YR 2/1) and very dark grayish brown (10YR 3/2). The B1 horizon is very dark grayish brown (10YR 3/2) or brown (10YR 4/3) with darker coatings on faces of peds. The B2 and B3 horizons range from brown (10YR 4/3) to yellowish brown (10YR 5/6).

The plow layer is neutral or slightly acid. The C horizon is slightly acid or neutral.

formation of the soils

This section describes the factors of soil formation and relates these factors to the soils in Butler County.

factors of soil formation

Soil forms through the processes of the environment acting on soil material that is deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (a) the physical and mineralogical composition of the parent material, (b) the climate under which the soil has accumulated and existed since accumulation, (c) the plant and animal life on and in the soil, (d) the relief, or lay of the land, and (e) the length of time the forces of soil formation have acted on the soil material (*3*).

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil profile. It may be much or little, but some time is required for horizon differentiation. Generally a long period is required for the development of distinct horizons. Man's influence on the soil is an additional important factor.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

parent material

The accumulation of parent material is the first step in the formation of a soil. Some of the soils in the county formed as the result of weathering of the bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity.

The principal parent materials in Butler County are glacial drift, loess, alluvium, and eolian or wind-deposited sand. Much less extensive parent materials are organic deposits and residuum.

Glacial drift is all of the rock material transported by glacier ice, all deposits made by glacier ice, and all deposits of dominantly glacial origin made in the sea or in bodies of glacial melt water. Glacial drift includes glacial till, unsorted sediment in which particles range in size from boulders to clay (*9*).

Glacial till is the most extensive parent material in the formation of the soils of Butler County. Twice during the glacial period, continental ice or glaciers moved over the entire county. The record of these ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and melt water streams (*4*).

The older ice sheet is known as the Nebraskan. It was followed by the Aftonian interglacial period. The second ice sheet is known as the Kansan. The Nebraskan glacial period started 1.5 to 2.0 million years ago, and the Kansan glacial period started about 1.2 million years ago (*6*). A more recent glaciation has been recognized as an Iowan substage of the Wisconsin glaciation (*5*), but other studies of the Iowan glacial till do not identify this period of glaciation (*10*). Studies since 1960 show that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into Kansan and Nebraskan till. In the vicinity of Alburnett, the Iowa till does not exist, but an erosion-surface complex does exists in the Iowan region (*9*). The Iowan surface is multilevel and is arranged in a series of steps from major drainageways toward boundary divides. The Iowan surface is marked where it cuts Kansan and Nebraskan till by a stone line. The stone line is on all levels of the stepped surfaces where they exist and passes under the alluvium along the drainageways.

Bassett, Clyde, Cresco, Floyd, Kenyon, Olin, Ostrander, Protivin, Readlyn, Riceville, Schley, and Tripoli soils formed in glacial drift and glacial till on the Iowan erosion surface. A loamy surficial sediment about 12 to 24 inches thick overlies the glacial material and is thicker in the Clyde, Floyd, and Schley soils on the lower concave slopes and in waterways. A stone line or pebble band commonly separates the friable, loamy, surficial sediment from the firm loam or very firm clay loam glacial till. The Donnan soils formed in loamy material, and the clayey paleosol derived from glacial till.

Loess is silty material deposited by wind. It consists mostly of silt and clay. It does not contain coarse sand

or gravel because those materials are commonly too large to be moved more than a short distance by wind, but it does contain small amounts of fine and very fine sand. The thickness of the loess is about 20 to 40 inches in most places but ranges from about 45 inches to more than 15 feet in a few places. Dinsdale, Klinger, Maxfield, and Waubeek soils formed in loess and the underlying glacial till. Downs, Garwin, Muscatine, Mt. Carroll, and Tama soils formed in the thicker deposits of loess.

Alluvium was deposited by water on the flood plains and benches along the streams and on upland outwash plains. This material occurs as lenses and layers of sand, gravel, silt, and clay. The major areas in which soils formed in alluvium are along the Shell Rock and West Fork of the Cedar Rivers and Beaver Creek and their major tributaries.

Some of the alluvial material has been transported only a short distance and has accumulated at the foot of the slope on which it originated. This material is called local alluvium, and it retains many characteristics of the soils in the area from which it was eroded. The Ely, Terril, and Worthen soils formed in this material.

Calco, Coland, Colo, Du Page, and Spillville soils are on the flood plains.

Flagler, Hanska, Hoopeston, Lawler, Marshan, Saude, Shandep, Wapsie, and Waukee soils are on the stream benches and outwash plains. These soils formed in moderately coarse textured to moderately fine textured loamy material, 20 to 40 inches thick, underlain by sand or gravel.

Ackmore, Bremer, Nevin, Raddle, and Thorp soils formed in medium textured and moderately fine textured silty sediment underlain by sand or gravel below a depth of about 4 to 8 feet or more. In the Burkhardt soils, sandy loam ranging from less than 5 inches to 15 inches in thickness is underlain by gravelly sand or gravel. Waukegan soils formed in 24 to 40 inches of medium textured silty sediment underlain by sand and gravel.

Eolian material is sandy and loamy parent material accumulated through wind. It consists of silt, fine and very fine sand, and a small amount of clay. Most of this material occurs as low mounds or dunes on the uplands and on the stream benches. The sand in these eolian deposits is largely quartz, which is highly resistant to weathering. It has not been altered appreciably since it was deposited. Bolan, Chelsea, Dickinson, Hoopeston, Lamont, and Sparta soils formed in this material.

Limestone is the most extensive sedimentary rock in Butler County. Except for a few outcrops, it is covered by glacial drift, loess, alluvium, and organic deposits. The thickness of this cover ranges from 4 to 40 inches in soils that are strongly affected by the bedrock, namely, Backbone, Rockton, Sogn, and Winneshiek soils.

Organic deposits consist of plant material that has accumulated on hillside seepy areas and drainageways that support a thick growth of water-tolerant plants. Organic soils occupy wet areas in the county where poor drainage has retarded the decay of plant remains that have accumulated over a period of time. In Butler County, the thickness of the organic material ranges from 51 to 84 inches or more in Houghton muck and from 16 to 50 inches in Palms muck.

climate

According to available evidence, the soils of Butler County formed under the influence of a midcontinental, subhumid climate over a period of at least 5,000 years. Between 5,000 and 16,000 years ago the climate was conducive to the growth of forest vegetation (*7*). The morphology of most of the soils in the county indicates that the climate under which the soils formed was similar to the present climate. At present, the climate is fairly uniform throughout the county but has wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate is a major factor in determining which soils develop from the various parent materials. The rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil are influenced by the climate. Temperature, rainfall, relative humidity, and length of the frost-free period are important in determining the vegetation.

The influence of the general climate of the region is somewhat modified by the local conditions in or near the forming soil. For example, dry, sandy, south-facing slopes have a local climate or microclimate that is warmer and less humid than the average climate of nearby areas. Low lying, poorly drained areas are wetter and colder than most areas around them. These contrasts account for some of the differences in soils within the same general climatic regions.

plant and animal life

Plant life and animal life are important factors in soil formation. Plant life is especially significant, because soil formation really begins with the coming of vegetation. As plants grow and die, their remains add organic matter to the upper layers of the soil. The native grasses have myriad fibrous roots that penetrate the soil to a depth of 10 to 20 inches; thus, large amounts of organic matter accumulate in the surface layer. Trees commonly feed on nutrients deep in the subsoil. Consequently, there is little accumulation of organic matter in the surface layer other than that gained from fallen leaves and trees. Much of the organic matter from leaves and trees remains on the surface or is lost through decomposition.

In Butler County, most soils formed under prairie vegetation. A few soils formed in small areas along major streams under a prairie-forest type of vegetation.

Typically, Dinsdale, Kenyon, Readlyn, and Waukee soils formed under prairie vegetation in Butler County. Clyde, Coland, and Marshan soils formed under prairie grasses and water-tolerant plants.

Organic matter content is high in soils that formed under prairie vegetation. As a result, these soils have a thick, dark colored surface layer.

Activities of burrowing animals and insects have some effect in loosening and aerating the upper few feet of a soil. In some sloping areas, cultivation followed by erosion has removed much of the dark colored surface layer.

relief

Relief is an important cause of differences among soils. Indirectly it influences soil formation through its effect on drainage. In Butler County, relief ranges from level to steep. Many nearly level areas are frequently flooded and have a high or seasonal high water table. On steeper slopes much of the rainfall is lost as runoff.

Generally, the soils in Butler County that are affected by a high or seasonal high water table have a dominantly olive gray subsoil. Clyde, Marshan, Maxfield, and Tripoli soils are examples. Dinsdale, Kenyon, Ostrander, and Saude soils have a yellowish brown subsoil and a water table that is below the subsoil. Floyd, Klinger, Readlyn, and Lawler soils formed where natural drainage is intermediate. They have a mottled, grayish brown subsoil. Soils that formed under prairie conditions and that have a high water table generally have higher organic matter content in the surface layer than those soils that have good natural drainage.

Aspect, as well as slope, affects soil formation. South-facing slopes generally are warmer and drier than north-facing slopes and consequently support a different kind and amount of vegetation.

The influence of porous, rapidly permeable parent material may override the influence of relief. Dickinson soils, for example, are somewhat excessively drained because they have moderately rapid permeability, but they are nearly level to moderately sloping.

Kenyon and Readlyn soils formed in the same kind of parent material and under similar vegetation, but they differ because of differences in topographic position. Kenyon soils are on gently sloping and moderately sloping ridge crests and side slopes. Readlyn soils are on nearly level and very gently sloping ridge crests and side slopes.

Ely and Worthen soils are on foot slopes. They have properties related to the soils upslope from which they receive sediment.

time

Time is necessary for the various processes of soil formation. The necessary amount of time ranges from a few hundred years for the formation of soils in alluvial deposits, such as Coland soils, to thousands of years for the paleosol that makes up the subsoil of Donnan soils. Generally, if other factors are favorable, the texture of the subsoil becomes finer and a greater amount of soluble material is leached as soils continue to weather. Exceptions to this are soils that formed in quartz sand, such as Sparta soils, or in other materials that are resistant to weathering. Such soils change only slightly over a long period of time.

Where organic material, such as trees, has been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by radiocarbon dating (*8*).

The loess that covers parts of Butler County is about 14,000 to 20,000 years old. Dinsdale, Tama, and Muscatine soils formed in this material. The maximum age for these soils on stable summits is 14,000 years (*8*). The Iowan erosion surface formed during the period of loess deposition, between 14,000 to 20,000 years ago (*10*). The Iowan surface beneath the loess possibly is as young as 14,000 years; this dates the close of the major period of loess deposition in Iowa. The surface might also be younger than the loess. Where the Iowan surface is covered by loam sediment, it is younger than 14,000 years (*10*). The erosional surface of loam sediment is the parent material of Kenyon, Ostrander, and Readlyn soils. Floyd soils are younger because they are below these higher lying soils.

Time is needed for soil formation, but the age of parent material does not necessarily reflect the true age of the soil profile.

man's influence on the soil

Important changes take place in a soil when it is drained and cultivated. Some of these changes have little effect on soil productivity; others have a drastic effect. Changes caused by erosion generally are the most apparent. On many of the cultivated soils in the county, particularly those on the steeper slopes, part or all of the original surface layer has been lost through sheet erosion. Even in fields that are not eroded, the compaction of the soil by heavy farm machinery reduces the thickness of the surface layer.

Man has done much to increase the productivity of soil and to reclaim areas not suited to crops. For example, tile drainage has been installed in many areas and has lowered the water table so that these areas can be cropped. Through the use of commercial fertilizers, man has been able to counteract deficiencies in plant nutrients and to make soils more productive than virgin soils. Most of the soils in Butler County have not been seriously affected by erosion, because much of the county has low relief, and past rotations have included a fairly high percentage of grass.

Man is able to improve the soil through good management. He can also cause a reduction in soil fertility and production through improper land use.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties

typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Allison, Iowa]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days[1]	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	25.3	6.9	16.1	48	-24	0	.86	.46	1.17	3	7.7
February---	31.5	12.9	22.2	52	-18	0	1.06	.31	1.65	3	7.3
March------	41.5	22.7	32.1	75	-6	20	2.26	1.13	3.17	6	10.9
April------	59.3	36.8	48.1	87	17	78	3.04	1.61	4.20	6	2.0
May--------	72.0	48.2	60.1	91	27	324	4.32	2.74	5.74	8	.0
June-------	81.5	58.1	69.8	96	42	594	5.23	2.54	7.42	7	.0
July-------	84.7	62.2	73.5	97	47	729	4.82	2.86	6.56	7	.0
August-----	83.4	60.2	71.8	97	44	676	3.78	1.94	5.28	6	.0
September--	74.7	51.0	62.9	93	32	387	3.46	1.17	5.28	7	.0
October----	64.3	41.2	52.8	87	20	175	2.32	.94	3.45	5	.0
November---	45.5	27.3	36.4	70	0	8	1.54	.54	2.33	4	3.5
December---	30.8	14.6	22.7	56	-18	0	1.31	.63	1.86	4	8.5
Year-----	57.9	36.8	47.4	98	-24	2,991	34.00	28.18	39.53	66	39.9

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Allison, Iowa]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 23	May 6	May 15
2 years in 10 later than--	April 18	April 30	May 11
5 years in 10 later than--	April 10	April 19	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 14	October 7	September 27
2 years in 10 earlier than--	October 18	October 11	October 1
5 years in 10 earlier than--	October 28	October 21	October 11

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Allison, Iowa]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	184	164	144
8 years in 10	189	171	149
5 years in 10	200	184	159
2 years in 10	211	197	168
1 year in 10	216	204	173

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
11B	Colo-Ely complex, 2 to 5 percent slopes	3,450	0.9
27B	Terril loam, 2 to 5 percent slopes	1,670	0.4
41B	Sparta loamy fine sand, 1 to 5 percent slopes	4,300	1.2
41C	Sparta loamy fine sand, 5 to 9 percent slopes	1,780	0.5
41D	Sparta loamy fine sand, 9 to 14 percent slopes	430	0.1
43	Bremer silty clay loam, 0 to 2 percent slopes	1,900	0.5
63C	Chelsea loamy fine sand, 2 to 9 percent slopes	380	0.1
83B	Kenyon loam, 2 to 5 percent slopes	34,190	9.2
83C	Kenyon loam, 5 to 9 percent slopes	1,175	0.3
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	15,795	4.2
83D2	Kenyon loam, 9 to 14 percent slopes, moderately eroded	830	0.2
84	Clyde silty clay loam, 0 to 3 percent slopes	31,250	8.4
88	Nevin silty clay loam, 0 to 2 percent slopes	1,730	0.5
109C	Backbone fine sandy loam, 2 to 9 percent slopes	200	*
110B	Lamont fine sandy loam, 2 to 5 percent slopes	565	0.2
110C	Lamont fine sandy loam, 5 to 9 percent slopes	300	0.1
118	Garwin silty clay loam, 0 to 2 percent slopes	3,145	0.8
119	Muscatine silty clay loam, 1 to 3 percent slopes	1,745	0.5
120	Tama silt loam, 0 to 2 percent slopes	295	0.1
120B	Tama silt loam, 2 to 5 percent slopes	1,350	0.4
133	Colo silty clay loam, 0 to 2 percent slopes	2,640	0.7
135	Coland clay loam, 0 to 2 percent slopes	16,395	4.4
150B	Hanska loam, 1 to 4 percent slopes	1,180	0.3
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	4,660	1.3
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	13,395	3.6
153	Shandep clay loam, 0 to 1 percent slopes	1,540	0.4
162C	Downs silt loam, 5 to 9 percent slopes	250	0.1
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	2,015	0.5
171	Bassett loam, 0 to 2 percent slopes	205	*
171B	Bassett loam, 2 to 5 percent slopes	4,195	1.1
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	1,995	0.5
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	755	0.2
171F	Bassett loam, 14 to 25 percent slopes	150	*
173	Hoopeston fine sandy loam, 0 to 2 percent slopes	2,680	0.7
173B	Hoopeston fine sandy loam, 2 to 5 percent slopes	2,570	0.7
174	Bolan loam, 0 to 2 percent slopes	625	0.2
174B	Bolan loam, 2 to 5 percent slopes	2,740	0.7
174C2	Bolan loam, 5 to 9 percent slopes, moderately eroded	610	0.2
175	Dickinson fine sandy loam, 0 to 2 percent slopes	800	0.2
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	6,505	1.7
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	2,020	0.5
177	Saude loam, 0 to 2 percent slopes	4,730	1.3
177B	Saude loam, 2 to 5 percent slopes	2,330	0.6
177C	Saude loam, 5 to 9 percent slopes	425	0.1
178	Waukee loam, 0 to 2 percent slopes	6,220	1.7
178B	Waukee loam, 2 to 5 percent slopes	705	0.2
184	Klinger silty clay loam, 1 to 3 percent slopes	9,435	2.5
198B	Floyd loam, 1 to 4 percent slopes	31,395	8.4
201B	Coland-Terril complex, 1 to 4 percent slopes	735	0.2
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes	550	0.1
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	1,775	0.5
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	1,205	0.3
214C	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	465	0.1
214C2	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded	740	0.2
221B	Palms muck, 2 to 5 percent slopes	315	0.1
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	3,580	1.0
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	6,650	1.8
241C2	Saude-Burkhardt complex, 2 to 9 percent slopes, moderately eroded	1,520	0.4
241E2	Saude-Burkhardt complex, 9 to 18 percent slopes, moderately eroded	280	0.1
284	Flagler sandy loam, 0 to 2 percent slopes	5,285	1.4
284B	Flagler sandy loam, 2 to 5 percent slopes	1,370	0.4
284C	Flagler sandy loam, 5 to 9 percent slopes	410	0.1
285C	Burkhardt sandy loam, 2 to 9 percent slopes	585	0.2
350	Waukegan silt loam, 0 to 2 percent slopes	795	0.2
354	Aquolls, ponded	685	0.2
377B	Dinsdale silty clay loam, 2 to 5 percent slopes	12,890	3.5
377C2	Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded	1,035	0.3
382	Maxfield silty clay loam, 0 to 2 percent slopes	4,150	1.1
391B	Clyde-Floyd complex, 1 to 4 percent slopes	16,970	4.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
394	Ostrander loam, 0 to 2 percent slopes	1,320	0.4
394B	Ostrander loam, 2 to 5 percent slopes	9,265	2.5
394C	Ostrander loam, 5 to 9 percent slopes	430	0.1
394C2	Ostrander loam, 5 to 9 percent slopes, moderately eroded	1,850	0.5
398	Tripoli silty clay loam, 0 to 2 percent slopes	5,235	1.4
399	Readlyn silty clay loam, 1 to 3 percent slopes	12,145	3.3
404	Thorp silt loam, 0 to 1 percent slopes	270	0.1
407B	Schley silt loam, 1 to 4 percent slopes	505	0.1
408B	Olin fine sandy loam, 2 to 5 percent slopes	1,610	0.4
408C	Olin fine sandy loam, 5 to 9 percent slopes	1,310	0.4
412C	Sogn loam, 2 to 9 percent slopes	930	0.2
412F	Sogn loam, 9 to 30 percent slopes	385	0.1
428B	Ely silt loam, 2 to 5 percent slopes	635	0.2
430	Ackmore silt loam, 1 to 3 percent slopes	305	0.1
457	Du Page loam, 0 to 2 percent slopes	1,580	0.4
485	Spillville loam, 0 to 2 percent slopes	6,050	1.6
585	Spillville-Coland complex, 0 to 2 percent slopes	1,370	0.4
621	Houghton muck, 0 to 2 percent slopes	240	0.1
662D	Mt. Carroll silt loam, 9 to 14 percent slopes	250	0.1
662D3	Mt. Carroll silt loam, 9 to 14 percent slopes, severely eroded	1,850	0.5
662F	Mt. Carroll silt loam, 14 to 25 percent slopes	560	0.2
662F3	Mt. Carroll silt loam, 14 to 25 percent slopes, severely eroded	305	0.1
713B	Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	280	0.1
714B	Winneshiek loam, 20 to 30 inches to limestone 2 to 5 percent slopes	290	0.1
733	Calco silty clay loam, 0 to 2 percent slopes	820	0.2
771B	Waubeek silt loam, 2 to 5 percent slopes	365	0.1
777	Wapsie loam, 0 to 2 percent slopes	225	0.1
777B	Wapsie loam, 2 to 5 percent slopes	355	0.1
781B	Lourdes loam, 2 to 5 percent slopes	825	0.2
781C2	Lourdes loam, 5 to 9 percent slopes, moderately eroded	230	0.1
782B	Donnan loam, 2 to 5 percent slopes	1,825	0.5
782C2	Donnan loam, 5 to 9 percent slopes, moderately eroded	210	*
783B	Cresco loam, 2 to 5 percent slopes	4,900	1.3
783C	Cresco loam, 5 to 9 percent slopes	485	0.1
783C2	Cresco loam, 5 to 9 percent slopes, moderately eroded	3,025	0.8
784B	Riceville loam, 1 to 4 percent slopes	520	0.1
798B	Protivin clay loam, 1 to 4 percent slopes	7,705	2.1
976	Raddle silt loam, 0 to 2 percent slopes	1,975	0.5
976B	Raddle silt loam, 2 to 5 percent slopes	275	0.1
981B	Worthen silt loam, 2 to 5 percent slopes	460	0.1
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes	5,730	1.5
5010	Pits, sand and gravel	310	0.1
5030	Pits, limestone	250	0.1
5040	Orthents, loamy	205	*
	Water	1,180	0.3
	Total	372,480	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
11B Colo-Ely	113	43	85	4.2	4.7	6.4	5.3
27B Terril	112	45	84	4.2	5.0	7.8	7.0
41B Sparta	61	23	45	2.0	2.5	4.3	3.2
41C Sparta	56	21	42	2.0	2.3	3.8	3.3
41D Sparta	---	---	35	1.6	2.2	3.6	3.0
43 Bremer	106	40	58	4.0	4.5	7.5	6.3
63C Chelsea	52	20	39	1.8	1.8	3.0	3.0
83B Kenyon	113	43	90	4.2	4.7	7.8	6.6
83C Kenyon	108	41	86	4.0	4.5	7.5	6.5
83C2 Kenyon	105	40	84	3.8	4.4	7.3	6.3
83D2 Kenyon	96	36	76	3.4	4.0	6.6	5.6
84 Clyde	102	39	82	6.6	4.0	6.6	5.5
88 Nevin	114	43	63	4.0	4.8	8.0	8.0
109C Backbone	50	19	35	2.0	2.1	3.5	3.0
110B Lamont	69	26	52	2.3	2.5	4.1	3.5
110C Lamont	64	24	48	2.1	2.3	3.8	3.3
118 Garwin	125	47	94	4.1	5.0	8.3	7.5
119 Muscatine	131	50	98	4.2	5.5	9.1	7.8
120 Tama	127	49	95	4.2	5.3	8.6	7.6
120B Tama	125	48	95	4.2	5.2	8.6	7.5
133 Colo	104	40	78	4.2	4.2	7.0	5.5
135 Coland	110	42	83	4.1	4.6	7.6	6.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
150B----------------------- Hanska	75	28	60	3.1	3.5	5.2	4.3
151----------------------- Marshan	91	35	70	3.6	4.0	6.0	5.2
152----------------------- Marshan	101	38	81	4.1	4.0	6.6	5.8
153----------------------- Shandep	85	32	68	3.3	3.4	5.6	4.7
162C----------------------- Downs	114	43	91	4.0	4.8	8.1	6.8
162C2---------------------- Downs	111	42	89	3.8	4.7	7.8	6.6
171----------------------- Bassett	107	40	85	4.0	4.5	7.5	6.5
171B----------------------- Bassett	107	40	85	4.0	4.5	7.5	6.5
171C2---------------------- Bassett	99	38	80	3.5	4.0	6.6	6.0
171D2---------------------- Bassett	90	34	72	3.2	3.8	6.3	5.3
171F----------------------- Bassett	---	---	---	2.3	2.6	4.5	4.1
173----------------------- Hoopeston	90	33	76	3.3	4.1	6.8	5.6
173B ---------------------- Hoopeston	86	34	70	3.2	3.6	6.4	5.6
174----------------------- Bolan	90	34	72	3.6	3.8	6.3	5.3
174B----------------------- Bolan	88	33	70	3.6	3.7	6.1	5.2
174C2---------------------- Bolan	80	30	65	3.3	3.4	5.7	4.6
175----------------------- Dickinson	83	32	62	2.7	3.0	5.0	5.0
175B----------------------- Dickinson	81	31	60	2.7	3.0	5.0	4.8
175C----------------------- Dickinson	76	29	57	2.5	2.8	4.6	4.5
177----------------------- Saude	78	30	62	3.0	3.3	5.5	4.6
177B----------------------- Saude	76	29	61	3.0	3.2	5.3	4.5
177C----------------------- Saude	71	27	57	2.8	3.0	5.0	4.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
178------------------------ Waukee	98	37	78	4.0	4.1	6.8	5.8
178B----------------------- Waukee	96	36	77	4.0	4.0	6.6	5.6
184------------------------ Klinger	125	47	93	4.2	5.2	8.6	7.5
198B----------------------- Floyd	106	40	85	4.1	4.5	7.5	6.9
201B----------------------- Coland-Terril	98	37	78	3.4	4.0	6.6	6.3
213------------------------ Rockton	100	38	80	3.8	4.2	7.0	6.1
213B----------------------- Rockton	96	36	77	3.6	4.0	6.6	5.9
214B----------------------- Rockton	76	29	60	2.6	3.0	5.0	4.3
214C, 214C2---------------- Rockton	71	27	57	2.5	2.8	4.6	3.9
221B----------------------- Palms	75	29	65	3.1	3.0	5.0	4.3
225------------------------ Lawler	85	32	68	3.7	3.6	6.0	5.0
226------------------------ Lawler	100	38	80	4.0	4.2	7.0	6.0
241C2---------------------- Saude-Burkhardt	56	21	42	1.6	2.1	3.3	2.9
241E2---------------------- Saude-Burkhardt	---	---	---	1.3	1.2	1.6	1.2
284------------------------ Flagler	72	27	58	2.3	3.0	5.0	4.3
284B----------------------- Flagler	70	26	56	2.1	2.9	4.8	4.1
284C----------------------- Flagler	65	25	52	1.7	2.7	4.5	3.8
285C----------------------- Burkhardt	36	14	29	1.0	1.2	2.0	1.6
350------------------------ Waukegan	89	35	71	3.3	4.0	6.3	5.6
354** Aquolls							
377B----------------------- Dinsdale	119	45	89	4.1	5.0	8.3	7.1
377C2---------------------- Dinsdale	111	42	83	3.8	4.6	7.6	6.6
382------------------------ Maxfield	119	45	89	4.2	5.0	8.3	6.6
391B----------------------- Clyde-Floyd	104	40	83	4.1	4.2	7.0	6.1

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
394------------------------ Ostrander	115	44	92	4.1	4.5	8.0	7.0
394B----------------------- Ostrander	113	43	90	4.1	4.5	7.8	6.8
394C----------------------- Ostrander	108	41	86	4.0	4.3	7.5	6.5
394C2---------------------- Ostrander	105	40	84	3.8	4.4	7.3	6.4
398------------------------ Tripoli	111	42	89	4.1	4.5	7.5	6.5
399------------------------ Readlyn	115	44	92	4.2	4.8	8.0	7.0
404------------------------ Thorp	90	38	72	3.3	3.8	5.3	4.6
407B----------------------- Schley	100	38	80	4.0	4.2	7.0	6.0
408B----------------------- Olin	97	37	73	3.0	4.1	6.8	5.8
408C----------------------- Olin	92	35	70	2.8	3.9	6.5	5.5
412C----------------------- Sogn	41	16	33	1.6	1.8	3.0	2.1
412F----------------------- Sogn	---	---	20	1.0	1.0	1.6	1.0
428B----------------------- Ely	124	47	93	4.0	5.3	8.8	7.5
430------------------------ Ackmore	106	40	58	3.8	4.5	7.5	6.5
457------------------------ Du Page	104	40	83	4.0	4.2	7.0	6.0
485------------------------ Spillville	122	46	98	4.2	5.1	8.6	7.3
585------------------------ Spillville-Coland	108	32	86	4.1	4.7	7.8	6.9
621------------------------ Houghton	70	27	56	3.3	2.8	4.6	4.2
662D----------------------- Mt. Carroll	105	40	84	3.8	4.4	7.3	6.2
662D3---------------------- Mt. Carroll	96	36	76	3.5	4.0	6.6	5.7
662F----------------------- Mt. Carroll	---	---	65	3.3	3.5	5.8	5.2
662F3---------------------- Mt. Carroll	---	---	57	3.0	3.0	5.0	4.3
713B----------------------- Winneshiek	90	34	72	3.6	3.8	5.4	5.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
714B: Winneshiek	70	27	56	2.6	2.9	4.8	4.1
733: Calco	99	38	84	4.2	4.2	7.0	5.3
771B: Waubeek	113	43	85	4.0	4.7	7.8	6.8
777: Wapsie	72	27	57	2.7	3.0	5.0	4.3
777B: Wapsie	70	27	56	2.6	2.9	4.8	4.1
781B: Lourdes	82	31	65	3.3	3.4	5.6	5.0
781C2: Lourdes	72	27	57	2.4	3.0	5.0	4.3
782B: Donnan	70	24	56	2.7	2.8	4.6	3.5
782C2: Donnan	60	22	48	2.3	2.4	4.0	2.9
783B: Cresco	88	33	70	3.3	3.7	6.1	5.3
783C: Cresco	83	32	66	3.3	3.5	5.8	5.0
783C2: Cresco	78	30	62	2.6	3.3	5.5	4.6
784B: Riceville	82	31	66	3.3	3.4	5.6	4.8
798B: Protivin	88	33	70	3.6	3.7	6.1	5.3
976: Raddle	122	45	98	4.1	5.0	8.3	7.1
976B: Raddle	120	45	96	4.0	4.9	8.2	7.0
981B: Worthen	120	46	95	4.0	5.2	8.4	7.4
1585: Spillville-Coland	---	---	---	3.3	---	---	---
5010**, 5030**. Pits							
5040**. Orthents							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	28,850	---	---	---
II	271,589	100,625	141,539	29,425
III	47,779	40,399	2,095	5,285
IV	7,290	2,410	---	4,880
V	9,827	---	9,827	---
VI	2,774	564	---	2,210
VII	1,315	---	---	1,315
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
41B, 41C, 41D------ Sparta	3s	Slight	Slight	Severe	Slight	Jack pine----------- Northern red oak---- Red pine------------	57 47 ---	Red pine, eastern white pine, jack pine.
43----------------- Bremer	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Silver maple--------	90 80	American sycamore, common hackberry, green ash, eastern cottonwood, silver maple.
63C---------------- Chelsea	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine, red pine, jack pine.
109C--------------- Backbone	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, black walnut, sugar maple, northern red oak, white oak.
110B, 110C--------- Lamont	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, white oak, northern red oak.
162C, 162C2-------- Downs	2o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
171, 171B, 171C2, 171D2------------- Bassett	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
171F--------------- Bassett	3r	Moderate	Moderate	Moderate	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
241C2*: Saude.								
Burkhardt---------	3o	Slight	Slight	Slight	Slight	Northern pin oak---- Jack pine-----------	52 ---	Eastern white pine, red pine, jack pine.
285C--------------- Burkhardt	3o	Slight	Slight	Slight	Slight	Northern pin oak---- Black oak----------- Jack pine-----------	52 --- ---	Eastern white pine, red pine, jack pine.
407B--------------- Schley	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple, white oak, northern red oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
430---------------- Ackmore	2o	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
662D, 662D3-------- Mt. Carroll	2o	Slight	Slight	Slight	Slight	Northern red oak---- American basswood--- Sugar maple---------	70 --- ---	Black walnut, eastern white pine, red pine, northern red oak, white oak.
662F, 662F3-------- Mt. Carroll	2r	Moderate	Moderate	Moderate	Slight	Northern red oak---- American basswood--- Sugar maple---------	70 --- ---	Black walnut, eastern white pine, red pine, white oak, northern red oak.
713B, 714B--------- Winneshiek	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, black walnut, white oak, northern red oak.
771B--------------- Waubeek	2o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, white oak, black walnut, sugar maple, northern red oak.
777, 777B---------- Wapsie	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, white spruce, black walnut, sugar maple, white oak, northern red oak.
781B, 781C2-------- Lourdes	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, white spruce, black walnut, sugar maple, white oak, northern red oak.
782B, 782C2-------- Donnan	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple, white oak, northern red oak.
784B--------------- Riceville	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple, white oak, northern red oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
11B*: Colo	---	Northern white-cedar, redosier dogwood, silky dogwood, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
Ely	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
27B Terril	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
41B, 41C, 41D Sparta	---	Siberian peashrub, lilac, Siberian crabapple, Russian-olive, eastern redcedar.	Red pine, jack pine.	Eastern white pine.	---
43 Bremer	Silky dogwood	Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, northern white-cedar, white fir, Norway spruce, blue spruce.	Eastern white pine.	Pin oak.
63C Chelsea	---	Eastern redcedar, Russian-olive, Siberian peashrub, Tatarian honeysuckle, lilac.	Bur oak, red pine, common hackberry, green ash, jack pine, Siberian crabapple.	Eastern white pine.	---
83B, 83C, 83C2, 83D2 Kenyon	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
84 Clyde	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Norway spruce, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
88 Nevin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
109C Backbone	---	Eastern redcedar, northern white-cedar, Russian-olive, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Bur oak, red pine, jack pine, green ash, common hackberry.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
110B, 110C-------- Lamont	---	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, red pine.	Green ash, eastern white pine.	---
118--------------- Garwin	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
119--------------- Muscatine	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
120, 120B--------- Tama	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
133--------------- Colo	---	Northern white-cedar, redosier dogwood, silky dogwood, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
135--------------- Coland	Common ninebark---	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Amur honeysuckle.	White spruce, northern white-cedar, Amur maple, white fir.	Green ash---------	Eastern cottonwood, silver maple.
150B-------------- Hanska	---	Northern white-cedar, tall purple willow, Tatarian honeysuckle, lilac.	White spruce, Amur maple.	Golden willow, green ash.	Eastern cottonwood.
151, 152---------- Marshan	---	Redosier dogwood, northern white-cedar, American plum, Tatarian honeysuckle, silky dogwood.	Amur maple, white spruce.	Golden willow, common hackberry, green ash.	Silver maple, eastern cottonwood.
153--------------- Shandep	---	Northern white-cedar, redosier dogwood, tall purple willow, Tatarian honeysuckle.	Siberian crabapple, Amur maple.	Silver maple, golden willow, green ash, Norway spruce.	Eastern cottonwood.
162C, 162C2------- Downs	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
171, 171B, 171C2, 171D2, 171F------ Bassett	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
173, 173B--------- Hoopeston	---	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, red pine.	Green ash, Norway spruce.	---
174, 174B, 174C2-- Bolan	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
175, 175B, 175C--- Dickinson	---	Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, red pine, Siberian crabapple.	Green ash, eastern white pine.	---
177, 177B, 177C--- Saude	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
178, 178B--------- Waukee	---	Amur honeysuckle, Tatarian honeysuckle, American plum, lilac.	Amur maple, eastern redcedar, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine, jack pine.	---
184--------------- Klinger	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
198B-------------- Floyd	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
201B*:					
Coland-----------	Common ninebark---	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Amur honeysuckle.	White spruce, northern white-cedar, Amur maple, white fir.	Green ash---------	Eastern cottonwood, silver maple.
Terril-----------	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
213, 213B, 214B, 214C, 214C2------ Rockton	---	Siberian peashrub, Siberian crabapple, Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, Amur maple, white spruce.	Eastern white pine, green ash, red pine.	Silver maple.
221B-------------- Palms	Common ninebark---	Silky dogwood, Tatarian honeysuckle, Amur privet, Amur honeysuckle, redosier dogwood.	Tall purple willow	Golden willow, black willow.	---
225, 226---------- Lawler	---	American plum, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, red pine.	Green ash, eastern white pine.	---
241C2*, 241E2*:					
Saude------------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
Burkhardt--------	Siberian peashrub	Eastern redcedar, Russian-olive, Siberian crab-apple, Tatarian honeysuckle, Peking cotoneaster, lilac.	Bur oak, eastern white pine, green ash, red pine, jack pine.	---	---
284, 284B, 284C--- Flagler	---	Amur privet, Tatarian honeysuckle, American plum, Amur honeysuckle.	Eastern redcedar, Amur maple, northern white cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	---
285C-------------- Burkhardt	Siberian peashrub	Eastern redcedar, Russian-olive, Siberian crab-apple, Tatarian honeysuckle, Peking cotoneaster, lilac.	Bur oak, eastern, white pine, green ash, red pine, jack pine.	---	---
350--------------- Waukegan	---	Siberian peashrub, Siberian crabapple, lilac, Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar, white spruce.	Green ash, eastern white pine, red pine, Norway spruce.	---
354*. Aquolls					
377B, 377C2------- Dinsdale	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
382. Maxfield	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
391B*: Clyde	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Norway spruce, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
Floyd	---	Northern white-cedar, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
394, 394B, 394C, 394C2. Ostrander	---	Gray dogwood, Tatarian honeysuckle, lilac.	Siberian crabapple, Amur maple, eastern redcedar, northern white-cedar.	Eastern white pine, green ash, common hackberry, red pine.	American elm.
398. Tripoli	---	Northern white-cedar, redosier dogwood, tall purple willow, Tatarian honeysuckle.	Norway spruce, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
399. Readlyn	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
404. Thorp	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
407B. Schley	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
408B, 408C. Olin	Gray dogwood, Siberian dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
412C, 412F. Sogn	Siberian peashrub	Amur honeysuckle, eastern redcedar, lilac, Tatarian honeysuckle.	Jack pine, red pine, eastern white pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
428B-------------- Ely	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
430--------------- Ackmore	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	White pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
457--------------- Du Page	---	Lilac, Tatarian honeysuckle, Siberian peashrub, Washington hawthorn.	Eastern redcedar, white spruce, northern white-cedar, Siberian crabapple, blue spruce.	Green ash, common hackberry, bur oak.	---
485--------------- Spillville	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
585*:					
Spillville-------	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
Coland-----------	Common ninebark---	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Amur honeysuckle.	White spruce, northern white-cedar, Amur maple, white fir.	Green ash---------	Eastern cottonwood, silver maple.
621--------------- Houghton	Common ninebark---	Silky dogwood, Amur privet, redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	---
662D, 662D3, 662F, 662F3------------ Mt. Carroll	---	Peking cotoneaster, gray dogwood, silky dogwood, lilac, Amur maple.	Northern white-cedar.	White spruce, red pine, Norway spruce.	Eastern white pine.
713B, 714B-------- Winneshiek	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
733--------------- Calco	---	Tatarian honey-suckle.	Russian-olive, eastern redcedar, white spruce, blue spruce.	Common hackberry, green ash, golden willow.	Eastern cottonwood.
771B-------------- Waubeek	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
777, 777B: Wapsie	---	Amur privet, lilac, Tatarian honeysuckle, Amur honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine, jack pine.	---
781B, 781C2: Lourdes	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, Amur honeysuckle.	Eastern redcedar, Amur maple, blue spruce.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
782B, 782C2: Donnan	---	American plum, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
783B, 783C, 783C2: Cresco	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, eastern white pine, common hackberry.	Silver maple.
784B: Riceville	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
798B: Protivin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
976, 976B: Raddle	Redosier dogwood, gray dogwood.	Autumn-olive, silky dogwood, Tatarian honeysuckle.	Amur maple, northern white-cedar, white spruce.	Eastern white pine, Norway spruce, red pine.	Silver maple.
981B: Worthen	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
1585*: Spillville	---	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, red pine, green ash.	Silver maple.
Coland	Common ninebark.	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Amur honeysuckle.	White spruce, northern white-cedar, Amur maple, white fir.	Green ash.	Eastern cottonwood, silver maple.
5010*, 5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11B*:					
Colo	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
27B Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
41B Sparta	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
41C Sparta	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
41D Sparta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
43 Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
63C Chelsea	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
83B Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.
83C, 83C2 Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
83D2 Kenyon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
84 Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
88 Nevin	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
109C Backbone	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
110B Lamont	Slight	Slight	Moderate: slope.	Slight	Slight.
110C Lamont	Slight	Slight	Severe: slope.	Slight	Slight.
118 Garwin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
119 Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
120 Tama	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
120B: Tama	Slight	Slight	Moderate: slope.	Slight	Slight.
133: Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
135: Coland	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
150B: Hanska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
151, 152: Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
153: Shandep	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: flooding, wetness.
162C, 162C2: Downs	Slight	Slight	Severe: slope.	Slight	Slight.
171: Bassett	Slight	Slight	Slight	Slight	Slight.
171B: Bassett	Slight	Slight	Moderate: slope.	Slight	Slight.
171C2: Bassett	Slight	Slight	Severe: slope.	Slight	Slight.
171D2: Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
171F: Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
173, 173B: Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
174: Bolan	Slight	Slight	Slight	Slight	Slight.
174B: Bolan	Slight	Slight	Moderate: slope.	Slight	Slight.
174C2: Bolan	Slight	Slight	Severe: slope.	Slight	Slight.
175: Dickinson	Slight	Slight	Slight	Slight	Slight.
175B: Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
175C: Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
177: Saude	Slight	Slight	Slight	Slight	Slight.
177B: Saude	Slight	Slight	Moderate: slope.	Slight	Slight.
177C: Saude	Slight	Slight	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
178------------------- Waukee	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
178B------------------ Waukee	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
184------------------- Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight------------	Slight.
198B------------------ Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
201B*:					
Coland----------------	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Terril----------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
213------------------- Rockton	Slight----------	Slight----------	Slight----------	Slight------------	Moderate: thin layer.
213B, 214B------------ Rockton	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight------------	Moderate: thin layer.
214C, 214C2----------- Rockton	Slight----------	Slight----------	Severe: slope.	Slight------------	Moderate: thin layer.
221B------------------ Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
225, 226-------------- Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight------------	Slight.
241C2*:					
Saude-----------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Burkhardt-------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Moderate: droughty.
241E2*:					
Saude-----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Burkhardt-------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: droughty, slope.
284------------------- Flagler	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
284B------------------ Flagler	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
284C------------------ Flagler	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.
285C------------------ Burkhardt	Slight----------	Slight----------	Moderate: slope.	Slight------------	Moderate: droughty.
350------------------- Waukegan	Slight----------	Slight----------	Slight----------	Slight------------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
354*. Aquolls					
377B: Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
377C2: Dinsdale	Slight	Slight	Severe: slope.	Slight	Slight.
382: Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
391B*:					
Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
394: Ostrander	Slight	Slight	Slight	Slight	Slight.
394B: Ostrander	Slight	Slight	Moderate: slope.	Slight	Slight.
394C, 394C2: Ostrander	Slight	Slight	Severe: slope.	Slight	Slight.
398: Tripoli	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
399: Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
404: Thorp	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
407B: Schley	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
408B: Olin	Slight	Slight	Moderate: slope.	Slight	Slight.
408C: Olin	Slight	Slight	Severe: slope.	Slight	Slight.
412C: Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
412F: Sogn	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
428B: Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
430: Ackmore	Severe: flooding, wetness.	Moderate: wetness, flooding.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
457: Du Page	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
485: Spillville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
585*:					
Spillville	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Coland	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
621 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
662D, 662D3 Mt. Carroll	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
662F, 662F3 Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
713B, 714B Winneshiek	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight	Moderate: thin layer.
733 Calco	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: flooding, wetness.
771B Waubeek	Slight	Slight	Moderate: slope.	Slight	Slight.
777 Wapsie	Slight	Slight	Slight	Slight	Slight.
777B Wapsie	Slight	Slight	Moderate: slope.	Slight	Slight.
781B Lourdes	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
781C2 Lourdes	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
782B Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
782C2 Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, slope.	Slight	Slight.
783B Cresco	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
783C, 783C2 Cresco	Severe: excess humus.	Severe: excess humus.	Severe: slope, excess humus.	Severe: excess humus.	Slight.
784B Riceville	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
798B Protivin	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
976 Raddle	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
976B------------------- Raddle	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
981B------------------- Worthen	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
1585*:					
Spillville-----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Coland---------------	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
5010*, 5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
11B*:										
Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
27B Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
41B Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C, 41D Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
43 Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
63C Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
83B Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C, 83C2, 83D2 Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
84 Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
88 Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
109C Backbone	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
110B Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
110C Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
118 Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
119 Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
120, 120B Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
133 Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
135 Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
150B Hanska	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
151, 152 Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
153----------------- Shandep	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
162C, 162C2--------- Downs	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
171, 171B----------- Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
171C2, 171D2-------- Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
171F---------------- Bassett	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
173, 173B----------- Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
174, 174B----------- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
174C2--------------- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
175, 175B----------- Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175C---------------- Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
177, 177B----------- Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
177C---------------- Saude	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
178, 178B----------- Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
184----------------- Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
198B---------------- Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
201B*:										
Coland-------------	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
Terril-------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
213, 213B, 214B, 214C, 214C2-------- Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
221B---------------- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
225, 226------------ Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
241C2*:										
Saude--------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Burkhardt----------	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
241E2*:										
Saude	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Burkhardt	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
284, 284B Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
284C Flagler	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285C Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
350 Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
354*. Aquolls										
377B Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
377C2 Dinsdale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
382 Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
391B*:										
Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
394, 394B Ostrander	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
394C, 394C2 Ostrander	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
398 Tripoli	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
399 Readlyn	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
404 Thorp	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
407B Schley	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
408B Olin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
408C Olin	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
412C, 412F Sogn	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
428B Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
430-----------------Ackmore	Very poor.	Poor	Good	Good	Good	Fair	Fair	Poor	Good	Fair.
457-----------------Du Page	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
485-----------------Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
585*:										
Spillville---------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland-------------	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
621-----------------Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
662D, 662D3---------Mt. Carroll	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
662F, 662F3---------Mt. Carroll	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
713B, 714B----------Winneshiek	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
733-----------------Calco	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
771B----------------Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
777, 777B-----------Wapsie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
781B----------------Lourdes	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
781C2---------------Lourdes	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
782B----------------Donnan	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
782C2---------------Donnan	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
783B----------------Cresco	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
783C, 783C2---------Cresco	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Fair.
784B----------------Riceville	Good	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
798B----------------Protivin	Good	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
976, 976B-----------Raddle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
981B----------------Worthen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1585*:										
Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
5010*, 5030*. Pits										
5040*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11B*:						
Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Severe: flooding.
Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
27B Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
41B Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
41D Sparta	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
43 Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: low strength, frost action.	Moderate: wetness.
63C Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
83B Kenyon	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
83C, 83C2 Kenyon	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
83D2 Kenyon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
84 Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
88 Nevin	Severe: wetness.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Severe: frost action, low strength.	Slight.
109C Backbone	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer.
110B Lamont	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
110C Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
118 Garwin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
119 Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
120, 120B Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
133 Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
135 Coland	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
150B Hanska	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
151, 152 Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
153 Shandep	Severe: wetness, cutbanks cave.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: flooding, wetness.
162C, 162C2 Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
171, 171B Bassett	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
171C2 Bassett	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
171D2 Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
171F Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
173, 173B Hoopeston	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
174, 174B Bolan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
174C2 Bolan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
175, 175B Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
175C Dickinson	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
177, 177B Saude	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
177C Saude	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
178, 178B--------- Waukee	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
184--------------- Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
198B-------------- Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
201B*:						
Coland-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Severe: flooding.
Terril-----------	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
213, 213B, 214B--- Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Moderate: thin layer.
214C, 214C2------- Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Moderate: thin layer.
221B-------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
225, 226---------- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
241C2*:						
Saude------------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
Burkhardt--------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
241E2*:						
Saude------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Burkhardt--------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
284, 284B, 284C--- Flagler	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
285C-------------- Burkhardt	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
350--------------- Waukegan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
354*. Aquolls						
377B-------------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
377C2: Dinsdale	Slight	Moderate: shrink-swell.	Slight	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
382: Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
391B*:						
Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
394, 394B: Ostrander	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
394C, 394C2: Ostrander	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
398: Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
399: Readlyn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
404: Thorp	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
407B: Schley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
408B: Olin	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
408C: Olin	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
412C: Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
412F: Sogn	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
428B: Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
430: Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
457: Du Page	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
485: Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
585*:						
Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Coland	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Severe: flooding.
621 Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
662D, 662D3 Mt. Carroll	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
662F, 662F3 Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
713B, 714B Winneshiek	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Moderate: thin layer.
733 Calco	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.	Moderate: flooding, wetness.
771B Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
777, 777B Wapsie	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
781B Lourdes	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
781C2 Lourdes	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
782B, 782C2 Donnan	Moderate: wetness, too clayey.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell, frost action.	Slight.
783B Cresco	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
783C, 783C2 Cresco	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action.	Slight.
784B Riceville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
798B Protivin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
976, 976B Raddle	Slight	Slight	Slight	Slight	Severe: frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
981B----------- Worthen	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
1585*:						
Spillville-------	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Coland-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Severe: flooding.
5010*, 5030*. Pits						
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B*:					
Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
27B Terril	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
41B Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C, 41D Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43 Bremer	Severe: percs slowly, wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness.	Poor: wetness.
63C Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
83B Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
83C, 83C2 Kenyon	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
83D2 Kenyon	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
84 Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
88 Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
109C Backbone	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.	Poor: area reclaim.
110B Lamont	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
110C Lamont	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
118 Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
119 Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
120----------------- Tama	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
120B---------------- Tama	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
133----------------- Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
135----------------- Coland	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
150B---------------- Hanska	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
151, 152------------ Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
153----------------- Shandep	Severe: flooding, wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, flooding, seepage.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
162C, 162C2--------- Downs	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171----------------- Bassett	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171B---------------- Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171C2--------------- Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171D2--------------- Bassett	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
171F---------------- Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
173, 173B----------- Hoopeston	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
174, 174B----------- Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
174C2--------------- Bolan	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175, 175B----------- Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
175C---------------- Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
177, 177B----------- Saude	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
177C---------------- Saude	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
178, 178B----------- Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
184----------------- Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
198B---------------- Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
201B*:					
Coland--------------	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
Terril--------------	Slight------------	Moderate: seepage, slope.	Slight------------	Slight------------	Good.
213, 213B, 214B----- Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
214C, 214C2--------- Rockton	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
221B---------------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
225, 226------------ Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
241C2*:					
Saude---------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
Burkhardt-----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
241E2*:					
Saude---------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
241E2*:					
Burkhardt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
284, 284B Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
284C Flagler	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
285C Burkhardt	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
350 Waukegan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
354*. Aquolls					
377B Dinsdale	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
377C2 Dinsdale	Slight	Severe: slope.	Slight	Slight	Good.
382 Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
391B*:					
Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
394 Ostrander	Slight	Moderate: seepage.	Slight	Slight	Fair: small stones.
394B Ostrander	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
394C, 394C2 Ostrander	Slight	Severe: slope.	Slight	Slight	Fair: small stones.
398 Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
399 Readlyn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
404 Thorp	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
407B Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
408B----------------- Olin	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
408C----------------- Olin	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
412C----------------- Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
412F----------------- Sogn	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
428B----------------- Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
430------------------ Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
457------------------ Du Page	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding.	Good.
485------------------ Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
585*:					
Spillville----------	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
Coland--------------	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
621------------------ Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
662D, 662D3---------- Mt. Carroll	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
662F, 662F3---------- Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
713B, 714B----------- Winneshiek	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
733------------------ Calco	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness.
771B----------------- Waubeek	Slight-----------	Severe: seepage.	Slight-----------	Slight-----------	Good.
777, 777B------------ Wapsie	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
781B: Lourdes	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
781C2: Lourdes	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
782B: Donnan	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
782C2: Donnan	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
783B: Cresco	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
783C, 783C2: Cresco	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
784B: Riceville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
798B: Protivin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
976: Raddle	Slight	Moderate: seepage.	Severe: seepage.	Slight	Good.
976B: Raddle	Slight	Moderate: slope, seepage.	Severe: seepage.	Slight	Good.
981B: Worthen	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
1585*:					
Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
Coland	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
5010*, 5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11B*:				
Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
27B Terril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
41B, 41C Sparta	Good	Probable	Improbable: too sandy.	Fair: too sandy.
41D Sparta	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
43 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
63C Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
83B, 83C, 83C2 Kenyon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
83D2 Kenyon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
84 Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
88 Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
109C Backbone	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Good.
118 Garwin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
119 Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120, 120B Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
133 Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
135 Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
150B Hanska	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
151, 152 Marshan	Fair: wetness.	Probable	Probable	Fair: area reclaim, thin layer.
153 Shandep	Poor: wetness.	Probable	Probable	Poor: wetness.
162C, 162C2 Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
171, 171B, 171C2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
171D2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
171F Bassett	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
173, 173B Hoopeston	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, thin layer.
174, 174B, 174C2 Bolan	Good	Probable	Improbable: too sandy.	Good.
175, 175B, 175C Dickinson	Good	Probable	Improbable: too sandy.	Good.
177, 177B, 177C Saude	Good	Probable	Probable	Good.
178, 178B Waukee	Good	Probable	Improbable: too sandy.	Good.
184 Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
198B Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
201B*:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Terril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
213, 213B, 214B, 214C, 214C2 Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
221B Palms	Poor: wetness.	Improbable: excess humus, excess fines.	Improbable: excess humus, excess fines.	Poor: wetness, excess humus.
225, 226 Lawler	Fair: wetness.	Probable	Probable	Poor: area reclaim.
241C2*:				
Saude	Good	Probable	Probable	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
241C2*:				
Burkhardt	Good	Probable	Probable	Poor: small stones, area reclaim.
241E2*:				
Saude	Good	Probable	Probable	Good.
Burkhardt	Good	Probable	Probable	Poor: small stones, area reclaim.
284, 284B, 284C Flagler	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
285C Burkhardt	Good	Probable	Probable	Poor: small stones, area reclaim.
350 Waukegan	Good	Probable	Improbable: too sandy.	Fair: area reclaim, thin layer.
354*. Aquolls				
377B, 377C2 Dinsdale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
382 Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
391B*:				
Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
394, 394B, 394C, 394C2 Ostrander	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
398 Tripoli	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
399 Readlyn	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
404 Thorp	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
407B Schley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
408B, 408C Olin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
412C Sogn	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
412F Sogn	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
428B Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
430 Ackmore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
457 Du Page	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
485 Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
585*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
621 Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
662D, 662D3 Mt. Carroll	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
662F, 662F3 Mt. Carroll	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
713B, 714B Winneshiek	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
733 Calco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
771B Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
777, 777B Wapsie	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
781B, 781C2 Lourdes	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
782B, 782C2 Donnan	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
783B, 783C, 783C2 Cresco	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
784B Riceville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
798B Protivin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
976, 976B: Raddle	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
981B: Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1585*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
5010*, 5030*. Pits				
5040*. Orthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
11B*:						
Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness	Wetness.
Ely	Moderate: slope, seepage.	Moderate: wetness.	Slope, frost action.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
27B Terril	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
41B, 41C Sparta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
41D Sparta	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
43 Bremer	Slight	Severe: wetness, hard to pack.	Frost action	Wetness	Wetness	Wetness.
63C Chelsea	Severe: seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
83B, 83C, 83C2 Kenyon	Moderate: slope, seepage.	Slight	Deep to water	Slope	Favorable	Favorable.
83D2 Kenyon	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
84 Clyde	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness, erodes easily.
88 Nevin	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
109C Backbone	Severe: seepage.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock, rooting depth.
110B, 110C Lamont	Severe: seepage.	Moderate: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
118 Garwin	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness.
119 Muscatine	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
120 Tama	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
120B Tama	Moderate: slope, seepage.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
133 Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness	Wetness.
135 Coland	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
150B: Hanska	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
151, 152: Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
153: Shandep	Moderate: seepage.	Severe: wetness.	Frost action, flooding.	Wetness, flooding.	Wetness	Wetness.
162C, 162C2: Downs	Moderate: slope, seepage.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
171: Bassett	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
171B, 171C2: Bassett	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
171D2, 171F: Bassett	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
173, 173B: Hoopeston	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
174: Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy	Favorable.
174B, 174C2: Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope	Too sandy	Favorable.
175: Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing	Soil blowing, too sandy.	Favorable.
175B, 175C: Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.
177: Saude	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
177B, 177C: Saude	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
178: Waukee	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
178B: Waukee	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
184: Klinger	Moderate: seepage.	Moderate: wetness, piping.	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
198B: Floyd	Severe: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Wetness	Favorable.
201B*:						
Coland	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
201B*:						
Terril	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
213 Rockton	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
213B, 214B, 214C, 214C2 Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
221B Palms	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
225, 226 Lawler	Severe: seepage.	Severe: seepage.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
241C2*:						
Saude	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
Burkhardt	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
241E2*:						
Saude	Severe: slope, seepage.	Severe: seepage.	Deep to water	Slope	Slope, too sandy.	Slope.
Burkhardt	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
284 Flagler	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
284B, 284C Flagler	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
285C Burkhardt	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
350 Waukegan	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Erodes easily, too sandy.	Erodes easily.
354*. Aquolls						
377B, 377C2 Dinsdale	Moderate: slope, seepage.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
382 Maxfield	Moderate: seepage.	Severe: wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
391B*:						
Clyde	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness, erodes easily.
Floyd	Severe: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Wetness	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
394 Ostrander	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
394B, 394C, 394C2 Ostrander	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
398 Tripoli	Moderate: seepage.	Severe: wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
399 Readlyn	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness	Favorable.
404 Thorp	Moderate: seepage.	Severe: ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
407B Schley	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness	Favorable.
408B, 408C Olin	Moderate: slope, seepage.	Slight	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
412C Sogn	Severe: depth to rock.	Slight	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
412F Sogn	Severe: depth to rock, slope.	Slight	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
428B Ely	Moderate: slope, seepage.	Moderate: wetness.	Slope, frost action.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
430 Ackmore	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.	Wetness, erodes easily.
457 Du Page	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Flooding	Favorable	Favorable.
485 Spillville	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
585*:						
Spillville	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
Coland	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
621 Houghton	Severe: seepage.	Severe: excess humus, ponding.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
662D, 662D3, 662F, 662F3 Mt. Carroll	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
713B, 714B Winneshiek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock	Depth to rock.
733 Calco	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
771B Waubeek	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Rooting depth, slope.	Erodes easily	Erodes easily, rooting depth.
777 Wapsie	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth	Too sandy	Rooting depth.
777B Wapsie	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth, slope.	Too sandy	Rooting depth.
781B, 781C2 Lourdes	Moderate: slope.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
782B, 782C2 Donnan	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Percs slowly.
783B, 783C, 783C2 Cresco	Moderate: slope.	Moderate: piping.	Deep to water	Rooting depth, slope.	Erodes easily	Erodes easily, rooting depth.
784B Riceville	Slight	Moderate: wetness.	Frost action	Wetness, rooting depth.	Wetness	Rooting depth.
798B Protivin	Slight	Moderate: wetness.	Frost action	Wetness, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
976 Raddle	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
976B Raddle	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
981B Worthen	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
1585*:						
Spillville	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
Coland	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
5010*, 5030*. Pits						
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
11B*:											
Colo	0-51	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	51-72	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ely	0-21	Silt loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	21-49	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	49-74	Silt loam, clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
27B Terril	0-32	Loam	CL	A-6	0-5	100	95-100	70-90	60-80	30-40	10-20
	32-60	Clay loam, loam	CL	A-6	0-5	100	100	85-95	65-85	25-40	10-20
41B, 41C, 41D Sparta	0-36	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	36-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
43 Bremer	0-21	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
	21-44	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	44-64	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	95-100	95-100	40-60	25-40
63C Chelsea	0-8	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	8-69	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
83B, 83C, 83C2, 83D2 Kenyon	0-16	Loam	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	16-49	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	49-66	Loam	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
84 Clyde	0-22	Silty clay loam, clay loam.	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	22-33	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	33-42	Sandy loam, loam	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	42-72	Loam, sandy clay loam, loamy sand.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
88 Nevin	0-23	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	23-44	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	44-74	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
109C Backbone	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	75-85	15-40	15-25	5-10
	10-33	Sandy loam, sandy clay loam.	SC, SM-SC	A-2, A-4	0-2	90-95	90-95	65-80	20-40	15-25	5-10
	33-37	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7	2-5	90-95	90-95	70-80	50-75	35-55	20-30
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110B, 110C Lamont	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	10-29	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	29-60	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
118-------------- Garwin	0-22	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	22-50	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	50-72	Silt loam, loam, sandy loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
119-------------- Muscatine	0-21	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	21-54	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	54-72	Silt loam, loam, sandy loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
120, 120B-------- Tama	0-13	Silt loam, silty clay loam.	ML	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	13-56	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
	56-80	Silty clay loam, silt loam, sandy loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
133-------------- Colo	0-51	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	51-72	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
135-------------- Coland	0-45	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	45-66	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
150B------------- Hanska	0-14	Loam-------------	ML, CL, CL-ML	A-4	0	98-100	95-100	80-95	50-65	<25	2-10
	14-34	Sandy loam, coarse sandy loam, loam.	SM, SM-SC, SC	A-4	0	98-100	95-100	65-80	35-50	<20	2-8
	34-61	Loamy sand, loamy coarse sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	95-100	90-100	50-75	5-25	<20	NP
151-------------- Marshan	0-15	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	15-29	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	29-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
152-------------- Marshan	0-15	Clay loam, silty clay loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	15-35	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	35-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
153-------------- Shandep	0-27	Clay loam--------	CL, CH	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	27-42	Silty clay loam, clay loam, loam, sandy clay loam.	CL	A-7	0	95-100	95-100	90-100	85-95	40-50	20-30
	42-48	Sandy loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0	95-100	80-90	75-80	30-50	20-30	3-10
	48-60	Loamy sand, gravelly loamy coarse sand, gravelly coarse sand.	SW, SP, SP-SM	A-1	0-5	65-90	60-80	20-45	2-5	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
162C, 162C2------ Downs	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-46	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	46-64	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
171, 171B, 171C2, 171D2, 171F----- Bassett	0-9	Loam, clay loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	9-46	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	46-60	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
173, 173B-------- Hoopeston	0-29	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	90-100	70-90	25-45	20-35	NP-10
	29-72	Loamy sand, sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10
174, 174B, 174C2- Bolan	0-17	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	17-34	Loam-------------	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	34-80	Loamy fine sand, fine sand, fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-4	0	100	100	70-90	10-50	0-20	NP-5
175, 175B, 175C-- Dickinson	0-15	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	15-24	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	24-72	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
177, 177B, 177C-- Saude	0-12	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	12-25	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	36-60	20-30	5-15
	25-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
178, 178B-------- Waukee	0-20	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	20-38	Loam, sandy clay loam.	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	38-60	Gravelly sand, loamy coarse sand, sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
184-------------- Klinger	0-19	Silty clay loam	CL, ML	A-7	0	100	100	100	95-100	40-50	15-25
	19-31	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	31-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
198B------------- Floyd	0-23	Loam-------------	OL, MH, ML, OH	A-7	0	100	100	80-90	55-75	45-60	15-25
	23-33	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	33-45	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	45-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
201B*:											
Coland----------	0-45	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	45-66	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
Terril----------	0-32	Loam-------------	CL	A-6	0-5	100	95-100	70-90	60-80	30-40	10-20
	32-60	Clay loam, loam	CL	A-6	0-5	100	100	85-95	65-85	25-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
213, 213B-------- Rockton	0-17	Loam-------------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	17-33	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	33-38	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
214B, 214C, 214C2----------- Rockton	0-13	Loam-------------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	13-24	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	24-27	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
221B------------- Palms	0-30	Sapric material	Pt	---	---	---	---	---	---	---	---
	30-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
225-------------- Lawler	0-14	Loam-------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	14-28	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	28-60	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
226-------------- Lawler	0-14	Loam-------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	14-35	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	35-64	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
241C2*, 241E2*: Saude-----------	0-12	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	12-25	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	36-60	20-30	5-15
	25-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
Burkhardt-------	0-12	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-70	25-40	<26	2-7
	12-17	Sandy loam, loam, fine gravelly sandy loam.	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	60-95	25-60	15-30	2-10
	17-64	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1	0	50-85	45-85	20-35	1-5	---	NP
284, 284B, 284C-- Flagler	0-15	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	15-25	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	25-60	Loamy sand, gravelly sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
285C------------- Burkhardt	0-12	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-70	25-40	<26	2-7
	12-17	Sandy loam, loam	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	60-95	25-60	15-30	2-10
	17-64	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1	0	50-85	45-85	20-35	1-5	---	NP
350-------------- Waukegan	0-16	Silt loam--------	ML	A-4	0	95-100	95-100	95-100	85-95	25-40	3-10
	16-33	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	85-95	25-40	5-15
	33-60	Gravelly coarse sand, gravelly sand, loamy sand	SP, SW, SP-SM	A-1	0-2	80-95	65-85	30-50	3-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
354*. Aquolls											
377B, 377C2------ Dinsdale	0-14	Silty clay loam	ML, CL	A-6, A-7	0	100	100	100	95-100	30-50	10-20
	14-29	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	29-73	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382-------------- Maxfield	0-18	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	18-34	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	34-80	Loam-------------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
391B*: Clyde-----------	0-22	Silty clay loam, clay loam.	OL, MH,	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	22-33	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	33-42	Sandy loam, loam	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	42-72	Loam, sandy clay loam, loamy sand.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
Floyd-----------	0-23	Loam-------------	OL, MH, ML, OH	A-7	0	100	100	80-90	55-75	45-60	15-25
	23-33	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	33-45	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	45-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
394, 394B, 394C, 394C2----------- Ostrander	0-21	Loam-------------	CL-ML, CL	A-4, A-6	0	100	98-100	90-95	70-90	25-40	5-15
	21-42	Loam, silt loam, sandy clay loam.	CL, CL-ML	A-4	0-1	95-100	95-100	90-95	70-90	25-40	5-15
	42-72	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-2	95-100	75-98	65-90	45-65	25-35	10-15
398-------------- Tripoli	0-24	Silty clay loam	CL	A-6, A-7	0	100	100	85-95	55-75	35-45	15-25
	24-40	Clay loam, loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	11-20
	40-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	11-20
399-------------- Readlyn	0-21	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-85	35-45	20-30
	21-43	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	43-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20
404-------------- Thorp	0-21	Silt loam--------	CL	A-6, A-4	0	95-100	95-100	90-100	75-95	20-40	8-19
	21-44	Silty clay loam	CL	A-7, A-6	0	95-100	95-100	90-100	75-95	35-50	13-27
	44-72	Silt loam, clay loam, sandy clay loam.	CL	A-6, A-4, A-7	0	90-100	90-100	90-100	70-90	20-50	8-26
407B------------- Schley	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-90	55-75	25-40	5-15
	11-42	Loam, sandy loam, silty clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4	2-8	90-95	70-80	50-70	20-60	20-30	5-10
	42-80	Loam, sandy clay loam, clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-40	10-20
408B, 408C------- Olin	0-30	Fine sandy loam, sandy loam.	SM-SC, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
	30-46	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	10-20
	46-72	Loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
412C, 412F------- Sogn	0-11	Loam, clay loam.	CL	A-6	0-10	85-100	85-100	85-100	70-95	25-40	11-23
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
428B------------- Ely	0-29	Silt loam, silty clay loam.	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	29-49	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	49-74	Silt loam, clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
430-------------- Ackmore	0-33	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	33-76	Silty clay loam, silt loam.	CH, CL, MH, ML	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
457-------------- Du Page	0-63	Loam, silt loam	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	11-21
	63-98	Sandy loam, loam, gravelly sandy clay loam.	CL	A-4, A-6, A-7	0	85-100	85-100	65-100	55-95	25-45	7-20
485-------------- Spillville	0-55	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	55-68	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
585*:											
Spillville------	0-55	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	55-68	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
Coland----------	0-45	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	45-66	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
621-------------- Houghton	0-75	Sapric material, hemic material, mucky silt loam.	Pt	A-8	0	---	---	---	---	---	---
662D, 662D3, 662F, 662F3----- Mt. Carroll	0-11	Silt loam--------	CL	A-4, A-6	0	100	100	100	95-100	25-36	7-18
	11-38	Silt loam--------	CL	A-6, A-4	0	100	100	100	95-100	27-40	8-20
	38-72	Silt loam, silt	CL	A-4, A-6	0	100	100	100	90-100	26-37	7-17
713B------------- Winneshiek	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	7-30	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	30-35	Clay, silty clay	CH	A-7	2-10	85-95	80-95	80-90	70-90	55-70	30-45
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
714B------------- Winneshiek	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	7-23	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	23-26	Clay, silty clay	CH	A-7	2-10	85-95	80-95	80-90	70-90	55-70	30-45
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
733-------------- Calco	0-32	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	32-60	Silty clay loam, loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	80-100	30-45	10-20
771B------------- Waubeek	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	8-32	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	100	40-50	15-25
	32-72	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
777, 777B--------Wapsie	0-7	Loam-------------	CL, ML, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	7-28	Loam, sandy loam, sand.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	85-95	80-95	70-85	40-60	20-35	5-15
	28-60	Gravelly loamy sand, gravelly sand.	SW, SM, SP, SP-SM	A-1	0	60-90	60-85	20-40	3-25	---	NP
781B, 781C2------Lourdes	0-7	Loam-------------	CL	A-6, A-7	0	100	100	90-95	65-80	35-45	10-20
	7-14	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	95-100	80-90	50-70	30-40	10-20
	14-40	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
	40-72	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
782B, 782C2------Donnan	0-8	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	65-80	30-40	5-15
	8-27	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-5	95-100	90-95	80-90	60-75	35-50	15-30
	27-56	Clay, silty clay, clay loam.	CH	A-7	0-5	95-100	90-95	80-90	60-75	55-70	30-40
	56-72	Clay loam, loam.	CL	A-6, A-7	2-5	95-100	85-95	80-90	55-75	35-45	15-25
783B, 783C, 783C2-----------Cresco	0-13	Loam-------------	OL, ML	A-6, A-7	0	100	100	90-100	70-80	35-50	10-20
	13-23	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-70	30-40	10-20
	23-72	Clay loam--------	CL	A-6	2-5	95-100	85-95	80-90	55-70	30-40	10-20
784B-------------Riceville	0-11	Loam-------------	CL	A-6, A-7	0	100	100	85-95	60-75	35-45	15-20
	11-18	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-20
	18-60	Clay loam--------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25
798B-------------Protivin	0-22	Loam, silty clay loam.	MH, OH, CL, ML	A-7	0	100	100	85-95	60-75	45-55	15-20
	22-56	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	35-40	15-20
	56-72	Clay loam, silty clay loam, loamy coarse sand.	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25
976, 976B--------Raddle	0-14	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	85-100	25-35	8-15
	14-80	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-30	4-14
981B-------------Worthen	0-19	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
	19-80	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
1585*: Spillville------	0-55	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	55-68	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
Coland----------	0-45	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	45-66	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
5010*, 5030*. Pits											
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
11B*:											
Colo------------	0-51	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	5-7
	51-72	30-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28			
Ely-------------	0-21	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
	21-49	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	49-74	20-28	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43			
27B-------------- Terril	0-32	18-26	1.35-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	5	6	4-5
	32-63	22-30	1.45-1.70	0.6-2.0	0.16-0.18	5.6-7.8	Low----------	0.32			
41B, 41C, 41D---- Sparta	0-36	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	5	2	.5-2
	36-60	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.17			
43--------------- Bremer	0-21	25-32	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	5-7
	21-44	35-42	1.30-1.40	0.2-0.6	0.15-0.17	6.1-6.5	High---------	0.28			
	44-64	32-38	1.40-1.45	0.2-0.6	0.18-0.20	6.1-7.8	High---------	0.28			
63C-------------- Chelsea	0-8	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2	.5-1
	8-69	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.5	Low----------	0.17			
83B, 83C, 83C2, 83D2------------ Kenyon	0-16	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	5	6	2-4
	16-49	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28			
	49-66	20-24	1.65-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.37			
84--------------- Clyde	0-22	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7	9-11
	22-33	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37			
	33-42	10-15	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.37			
	42-72	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37			
88--------------- Nevin	0-23	26-29	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
	23-44	30-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43			
	44-74	25-36	1.40-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
109C------------- Backbone	0-10	8-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.24	4	3	1-2
	10-33	12-18	1.55-1.65	2.0-6.0	0.11-0.13	5.1-7.3	Low----------	0.24			
	33-37	36-42	1.65-1.80	0.2-0.6	0.14-0.16	5.6-7.3	High---------	0.24			
	37	---	---	---	---	---	-------------	----			
110B, 110C------- Lamont	0-10	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3	.5-1
	10-29	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24			
	29-60	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24			
118-------------- Garwin	0-22	30-35	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	6-7
	22-50	28-34	1.28-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28			
	50-72	20-26	1.35-1.45	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.28			
119-------------- Muscatine	0-21	28-30	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	5-6
	21-54	30-34	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	54-72	22-26	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.43			
120, 120B-------- Tama	0-13	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	7	3-4
	13-56	28-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	56-80	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
133-------------- Colo	0-51	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	5-7
	51-72	30-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.8	High---------	0.28			
135-------------- Coland	0-45	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	45-66	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
150B------------- Hanska	0-14	6-18	1.30-1.40	2.0-6.0	0.20-0.22	6.1-7.8	Low----------	0.28	4	5	4-8
	14-34	6-18	1.35-1.50	2.0-6.0	0.10-0.13	6.1-7.3	Low----------	0.28			
	34-61	2-10	1.50-1.60	6.0-20	0.08-0.10	6.1-7.8	Low----------	0.17			
151-------------- Marshan	0-15	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7	6-7
	15-29	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28			
	29-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15			
152-------------- Marshan	0-15	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7	6-7
	15-35	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28			
	35-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15			
153-------------- Shandep	0-27	26-32	1.35-1.40	0.6-2.0	0.20-0.23	6.1-7.8	Moderate-----	0.24	5	7	7-9
	27-42	26-32	1.40-1.60	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.24			
	42-48	8-12	1.60-1.70	2.0-6.0	0.12-0.14	6.1-7.8	Low----------	0.24			
	48-60	2-8	1.60-1.70	6.0-20	0.02-0.04	6.1-8.4	Low----------	0.15			
162C, 162C2------ Downs	0-11	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.32	5-4	6	1-3
	11-46	26-34	1.30-1.35	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.43			
	46-64	22-26	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
171, 171B, 171C2, 171D2, 171F----- Bassett	0-9	18-25	1.45-1.50	0.6-2.0	0.19-0.21	5.1-6.5	Low----------	0.28	5-4	6	1-3
	9-46	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-5.5	Low----------	0.28			
	46-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low----------	0.37			
173, 173B-------- Hoopeston	0-29	8-18	1.35-1.70	2.0-6.0	0.12-0.15	5.1-7.3	Low----------	0.28	4	3	2-3
	29-72	2-10	1.50-1.80	6.0-20	0.05-0.10	5.6-7.8	Low----------	0.28			
174, 174B, 174C2- Bolan	0-17	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	6	1-3
	17-34	14-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.28			
	34-80	2-8	1.60-1.70	6.0-20	0.08-0.10	6.1-7.3	Low----------	0.17			
175, 175B, 175C-- Dickinson	0-15	12-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	4	3	1-2
	15-24	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.20			
	24-72	5-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.20			
177, 177B, 177C-- Saude	0-12	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	5	3-4
	12-25	12-20	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.5	Low----------	0.28			
	25-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Very low-----	0.10			
178, 178B-------- Waukee	0-20	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6	3-4
	20-38	20-26	1.40-1.50	0.6-2.0	0.15-0.19	4.5-6.5	Low----------	0.32			
	38-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-7.3	Low----------	0.10			
184-------------- Klinger	0-19	26-30	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	6	5-6
	19-31	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	31-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-7.8	Low----------	0.43			
198B------------- Floyd	0-23	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6	5-7
	23-33	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.32			
	33-45	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.32			
	45-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-7.8	Low----------	0.32			
201B*:											
Coland----------	0-45	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	45-66	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			
Terril----------	0-32	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	6	4-5
	32-60	22-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low----------	0.32			
213, 213B-------- Rockton	0-17	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.28	4	6	3-4
	17-33	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28			
	33-38	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High---------	0.28			
	38	---	---	---	---	---	-------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
214B, 214C, 214C2-----------Rockton	0-13	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	4	6	2-4
	13-24	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28			
	24-27	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High---------	0.28			
	27	---	---	---	---	---	-------------	----			
221B-------------Palms	0-30	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	3	>25
	30-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
225--------------Lawler	0-14	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6	4-5
	14-28	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.28			
	28-60	2-12	1.60-1.75	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
226--------------Lawler	0-14	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6	4-5
	14-35	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.28			
	35-64	2-12	1.60-1.75	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
241C2*, 241E2*:											
Saude-----------	0-12	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	5	1-3
	12-25	12-20	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low-----------	0.28			
	25-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Very low-----	0.10			
Burkhardt-------	0-12	5-12	1.35-1.55	2.0-6.0	0.13-0.15	5.1-6.5	Low-----------	0.20	3	3	.5-1
	12-17	8-18	1.55-1.65	2.0-6.0	0.11-0.19	5.1-6.5	Low-----------	0.20			
	17-64	1-6	1.50-1.60	>6.0	0.02-0.04	5.6-6.5	Low-----------	0.10			
284, 284B, 284C--Flagler	0-15	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low-----------	0.20	4	3	1-2
	15-25	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low-----------	0.20			
	25-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.20			
285C-------------Burkhardt	0-12	5-12	1.35-1.55	2.0-6.0	0.13-0.15	5.1-6.5	Low-----------	0.20	3	3	1-2
	12-17	8-18	1.55-1.65	2.0-6.0	0.11-0.19	5.1-6.5	Low-----------	0.20			
	17-64	1-6	1.50-1.60	>6.0	0.02-0.04	5.6-6.5	Low-----------	0.10			
350--------------Waukegan	0-16	18-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	6	3-4
	16-33	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43			
	33-60	1-10	1.50-1.70	6.0-20	0.02-0.04	5.6-7.8	Low-----------	0.10			
354*. Aquolls											
377B, 377C2------Dinsdale	0-14	25-29	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7	2-4
	14-29	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	29-73	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-8.4	Low-----------	0.43			
382--------------Maxfield	0-18	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High---------	0.24	5	6	6-7
	18-34	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.32			
	34-80	20-26	1.65-1.85	0.6-2.0	0.17-0.19	6.1-7.8	Low-----------	0.32			
391B*:											
Clyde-----------	0-22	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7	9-11
	22-33	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37			
	33-42	10-15	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low-----------	0.37			
	42-72	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37			
Floyd-----------	0-23	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6	5-7
	23-33	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low-----------	0.32			
	33-45	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.1-7.3	Low-----------	0.32			
	45-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-7.8	Low-----------	0.32			
394, 394B, 394C, 394C2-----------Ostrander	0-21	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	2-4
	21-42	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low-----------	0.28			
	42-72	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
398-------------- Tripoli	0-24	28-32	1.40-1.45	0.6-2.0	0.19-0.21	6.6-7.3	Moderate-----	0.24	5	6	6-7
	24-40	22-28	1.45-1.70	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.32			
	40-60	20-28	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low----------	0.32			
399-------------- Readlyn	0-21	27-30	1.40-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	4-6
	21-43	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.32			
	43-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.32			
404-------------- Thorp	0-21	20-27	1.15-1.35	0.2-0.6	0.22-0.24	5.1-7.8	Low----------	0.37	4	6	4-6
	21-44	27-35	1.35-1.55	0.06-0.2	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	44-72	20-30	1.40-1.60	0.06-0.2	0.15-0.22	5.6-7.8	Moderate-----	0.37			
407B------------- Schley	0-11	18-22	1.40-1.45	0.6-2.0	0.19-0.21	4.5-6.5	Moderate-----	0.32	5	6	2-3
	11-42	15-28	1.45-1.65	0.6-2.0	0.12-0.16	4.5-6.5	Low----------	0.32			
	42-80	20-28	1.65-1.80	0.6-2.0	0.16-0.18	5.1-7.8	Low----------	0.32			
408B, 408C------- Olin	0-30	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low----------	0.20	5	3	1-2
	30-46	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-6.3	Low----------	0.32			
	46-72	20-28	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low----------	0.32			
412C, 412F------- Sogn	0-11	18-25	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate-----	0.32	1	4L	2-3
	11	---	---	---	---	---	-------------	----			
428B------------- Ely	0-29	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
	29-49	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	49-74	20-28	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43			
430-------------- Ackmore	0-33	25-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.37	5	6	2-4
	33-76	26-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.37			
457-------------- Du Page	0-63	18-27	1.40-1.60	0.6-2.0	0.22-0.24	6.6-8.4	Moderate-----	0.28	5	6	4-6
	63-98	18-27	1.45-1.65	0.6-2.0	0.10-0.20	7.4-8.4	Low----------	0.28			
485-------------- Spillville	0-55	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	55-68	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			
585*:											
Spillville------	0-55	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	55-68	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			
Coland----------	0-45	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	45-66	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			
621-------------- Houghton	0-75	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	3	>25
662D, 662D3, 662F, 662F3----- Mt. Carroll	0-11	15-22	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	<3
	11-38	18-27	1.15-1.30	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
	38-72	16-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.43			
713B------------- Winneshiek	0-7	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low----------	0.28	4	6	2-3
	7-30	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low----------	0.28			
	30-35	40-55	1.70-1.80	0.06-0.2	0.12-0.15	5.6-7.3	High---------	0.28			
	35	---	---	---	---	---	-------------	----			
714B------------- Winneshiek	0-7	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low----------	0.28	4	6	2-3
	7-23	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low----------	0.28			
	23-26	40-55	1.70-1.80	0.06-0.2	0.12-0.15	5.6-7.3	High---------	0.28			
	26	---	---	---	---	---	-------------	----			
733-------------- Calco	0-32	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28	5	7	5-7
	32-60	22-32	1.30-1.45	0.6-2.0	0.18-0.20	7.4-8.4	Moderate-----	0.28			
771B------------- Waubeek	0-8	19-24	1.25-1.30	2.0-6.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5-4	6	2-3
	8-32	25-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	32-72	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
777, 777B--------- Wapsie	0-7	12-18	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Low----------	0.28	4	6	1-2
	7-28	12-18	1.45-1.50	0.6-2.0	0.15-0.17	5.6-6.0	Low----------	0.28			
	28-60	2-10	1.50-1.75	>20.0	0.02-0.06	5.1-7.3	Low----------	0.10			
781B, 781C2------ Lourdes	0-7	20-27	1.45-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	3-2	6	1-3
	7-14	24-33	1.45-1.60	0.6-2.0	0.16-0.18	4.5-5.5	Low----------	0.37			
	14-40	28-33	1.45-1.60	0.2-0.6	0.15-0.17	4.5-6.5	Moderate-----	0.37			
	40-72	28-33	1.60-1.85	0.2-0.6	0.15-0.17	7.4-7.8	Moderate-----	0.37			
782B, 782C2------ Donnan	0-8	20-26	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.28	4	6	1-3
	8-27	28-34	1.45-1.55	0.6-2.0	0.17-0.19	5.1-5.5	Moderate-----	0.28			
	27-56	42-55	1.65-1.80	<0.06	0.11-0.14	5.6-6.5	High---------	0.28			
	56-72	28-32	1.70-1.80	0.2-0.6	0.17-0.19	5.6-6.5	Moderate-----	0.28			
783B, 783C, 783C2------------ Cresco	0-13	20-28	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.28	4	6	2-4
	13-23	20-28	1.50-1.60	0.2-0.6	0.15-0.17	5.1-6.0	Moderate-----	0.28			
	23-72	28-35	1.60-1.85	0.2-0.6	0.17-0.19	5.1-7.8	Moderate-----	0.37			
784B-------------- Riceville	0-11	22-27	1.45-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.32	4	6	3-4
	11-18	24-33	1.50-1.60	0.2-0.6	0.17-0.19	4.5-5.5	Moderate-----	0.32			
	18-60	30-35	1.60-1.85	0.2-0.6	0.15-0.17	4.5-7.8	Moderate-----	0.32			
798B-------------- Protivin	0-22	20-27	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.28	5	6	5-7
	22-56	20-27	1.50-1.60	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37			
	56-72	28-33	1.60-1.85	0.2-0.6	0.15-0.17	6.1-7.8	Moderate-----	0.37			
976, 976B--------- Raddle	0-14	18-24	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	3-4
	14-80	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
981B-------------- Worthen	0-19	15-22	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5-4	6	3-4
	19-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.43			
1585*: Spillville-------	0-55	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	55-68	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			
Coland-----------	0-45	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	45-66	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			
5010*, 5030*. Pits											
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
11B*:												
Colo	B/D	Frequent	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
27B Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
41B, 41C, 41D Sparta	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
43 Bremer	C	Rare	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
63C Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
83B, 83C, 83C2, 83D2 Kenyon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
84 Clyde	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Low.
88 Nevin	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Low.
109C Backbone	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Low	Low.
110B, 110C Lamont	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
118 Garwin	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
119 Muscatine	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
120, 120B Tama	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
133 Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
135 Coland	B/D	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
150B: Hanska	C	None	---	---	0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
151, 152: Marshan	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Moderate.
153: Shandep	B/D	Frequent	Brief to long.	Mar-Nov	0-1.0	Apparent	Jan-Dec	>60	---	High	High	Moderate.
162C, 162C2: Downs	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
171, 171B, 171C2, 171D2, 171F: Bassett	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
173, 173B: Hoopeston	B	None	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High	Low	Moderate.
174, 174B, 174C2: Bolan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175, 175B, 175C: Dickinson	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
177, 177B, 177C: Saude	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
178, 178B: Waukee	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
184: Klinger	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
198B: Floyd	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Low.
201B*:												
Coland	B/D	Frequent	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
213, 213B, 214B, 214C, 214C2: Rockton	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	Low.
221B: Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
225, 226: Lawler	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
241C2*, 241E2*:												
Saude	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
241C2*, 241E2*:												
Burkhardt----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	High.
284, 284B, 284C--- Flagler	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
285C---------------- Burkhardt	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	High.
350----------------- Waukegan	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Moderate.
354*. Aquolls												
377B, 377C2-------- Dinsdale	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
382----------------- Maxfield	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
391B*:												
Clyde--------------	B/D	None---------	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High------	High------	Low.
Floyd--------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
394, 394B, 394C, 394C2------------- Ostrander	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
398----------------- Tripoli	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
399----------------- Readlyn	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
404----------------- Thorp	C/D	None---------	---	---	+.5-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
407B---------------- Schley	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	High.
408B, 408C--------- Olin	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
412C, 412F--------- Sogn	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low-------	Low.
428B---------------- Ely	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
430----------------- Ackmore	B	Frequent-----	Very brief to brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High------	High------	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
457----------------- Du Page	B	Occasional	Brief-----	Apr-Jun	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Low------	Low.
485----------------- Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
585*:												
Spillville--------	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
Coland------------	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
621----------------- Houghton	A/D	None---------	---	---	+-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
662D, 662D3, 662F, 662F3------------ Mt. Carroll	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
713B, 714B--------- Winneshiek	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
733----------------- Calco	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
771B--------------- Waubeek	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
777, 777B---------- Wapsie	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
781B, 781C2-------- Lourdes	C	None---------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
782B, 782C2-------- Donnan	C	None---------	---	---	2.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
783B, 783C, 783C2- Cresco	C	None---------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
784B--------------- Riceville	C	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
798B--------------- Protivin	C	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
976, 976B---------- Raddle	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
981B--------------- Worthen	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
1585*:												
Spillville--------	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1585*:												
Coland-----------	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
5010*, 5030*. Pits												
5040*. Orthents												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Aquolls	Loamy, mixed, mesic Typic Haplaquolls
Backbone	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
*Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Calco	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Chelsea	Mixed, mesic Alfic Udipsamments
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Cresco	Fine-loamy, mixed, mesic Typic Argiudolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Donnan	Fine-loamy over clayey, mixed, mesic Aquollic Hapludalfs
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Du Page	Fine-loamy, mixed, mesic Cumulic Hapludolls
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Garwin	Fine-silty, mixed, mesic Typic Haplaquolls
Hanska	Coarse-loamy, mixed, mesic Typic Haplaquolls
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Houghton	Euic, mesic Typic Medisaprists
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lourdes	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
Mt. Carroll	Fine-silty, mixed, mesic Mollic Hapludalfs
Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
*Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Olin	Coarse-loamy, mixed, mesic Typic Hapludolls
Orthents	Loamy, mixed, mesic Udorthents
Ostrander	Fine-loamy, mixed, mesic Typic Hapludolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Protivin	Fine-loamy, mixed, mesic Aquic Argiudolls
Raddle	Fine-silty, mixed, mesic Typic Hapludolls
Readlyn	Fine-loamy, mixed, mesic Aquic Hapludolls
Riceville	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Schley	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Shandep	Fine-loamy, mixed, mesic Cumulic Haplaquolls
*Sogn	Loamy, mixed, mesic Lithic Haplustolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
*Thorp	Fine-silty, mixed, mesic Argiaquic Argialbolls
Tripoli	Fine-loamy, mixed, mesic Typic Haplaquolls
Wapsie	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Waubeek	Fine-silty, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Waukegan	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Winneshiek	Fine-loamy, mixed, mesic Mollic Hapludalfs
Worthen	Fine-silty, mixed, mesic Cumulic Hapludolls

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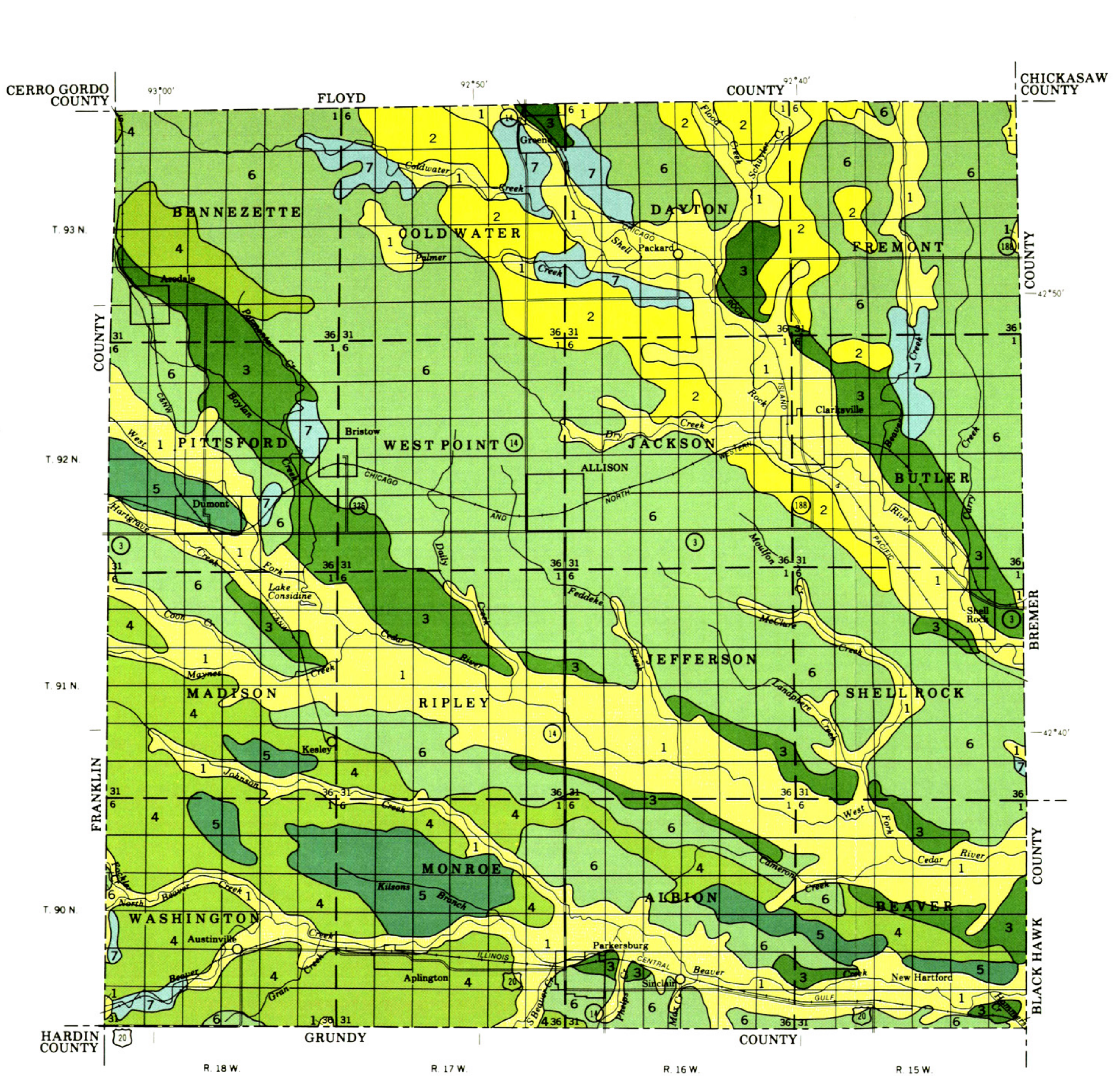
SOIL CONSERVATION SERVICE
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE, IOWA STATE UNIVERSITY
DEPARTMENT OF SOIL CONSERVATION, STATE OF IOWA

GENERAL SOIL MAP

BUTLER COUNTY, IOWA

Scale 1:190,080



Scale bar: 1 0 1 2 3 4 Miles; 1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND

1 Marshan-Coland-Flagler association: Nearly level to moderately sloping, poorly drained and somewhat excessively drained soils that formed in loamy sediment underlain by loamy, sandy, or gravelly alluvial sediment; on stream benches and bottom lands

2 Cresco-Kenyon-Clyde association: Nearly level to strongly sloping, moderately well drained and poorly drained soils that formed in loamy sediment and the underlying glacial till; on uplands

3 Dickinson-Sparta association: Nearly level to strongly sloping, well drained to excessively drained soils that formed in loamy and sandy material; on uplands

4 Dinsdale-Klinger-Maxfield association: Nearly level to moderately sloping, well drained, somewhat poorly drained, and poorly drained soils that formed in loess and the underlying glacial till; on uplands

5 Mt. Carroll-Downs-Garwin association: Nearly level to steep, well drained and poorly drained soils that formed in loess; on uplands

6 Kenyon-Clyde-Floyd association: Nearly level to strongly sloping, moderately well drained to poorly drained soils that formed in loamy sediment and the underlying glacial till; on uplands

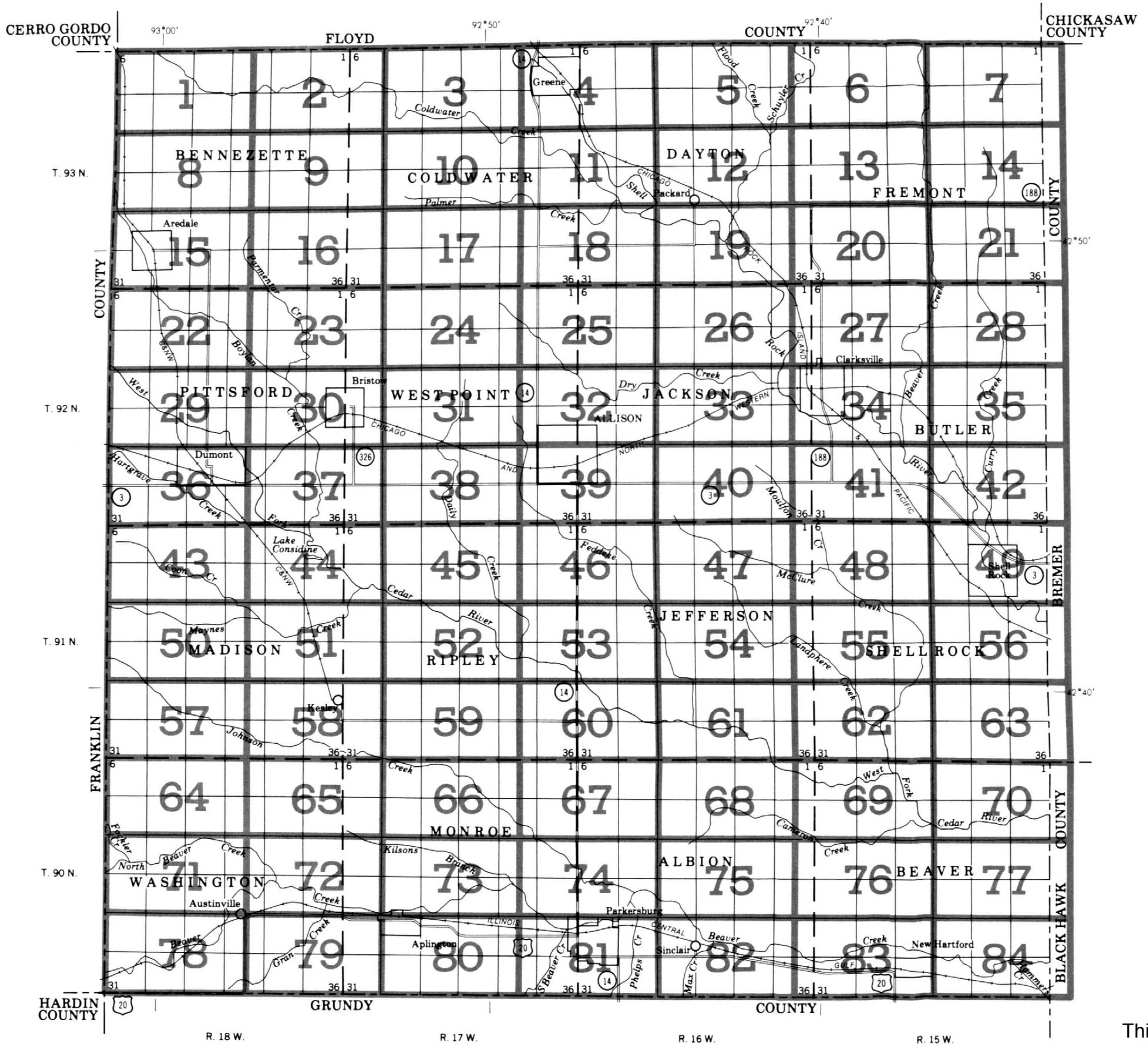
7 Rockton-Ostrander association: Nearly level to moderately sloping, well drained soils that formed in loamy sediment and the underlying glacial till and limestone residuum; on uplands

Compiled 1981

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



N

INDEX TO MAP SHEETS

BUTLER COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

Original text from each individual map sheet read:
This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 83C; 798B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

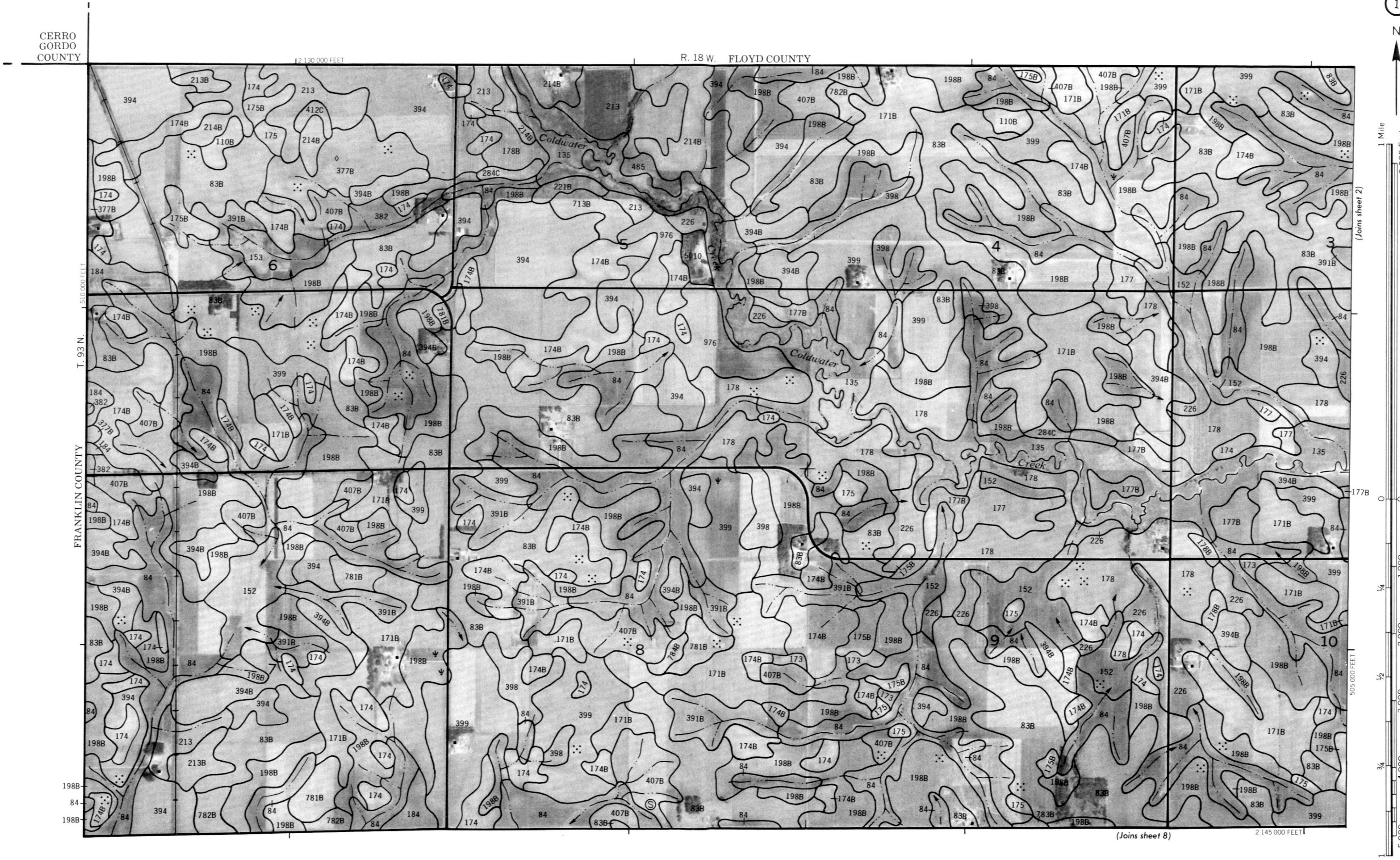
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Dense gray clay at depths of 20 to 36 inches
- Muck spot
- Calcareous spot
- Limestone at depths of 20 to 40 inches
- Shale at depths of 2 to 3 feet
- Spot of Orthents, loamy
- Spot of glacial till

SOIL LEGEND

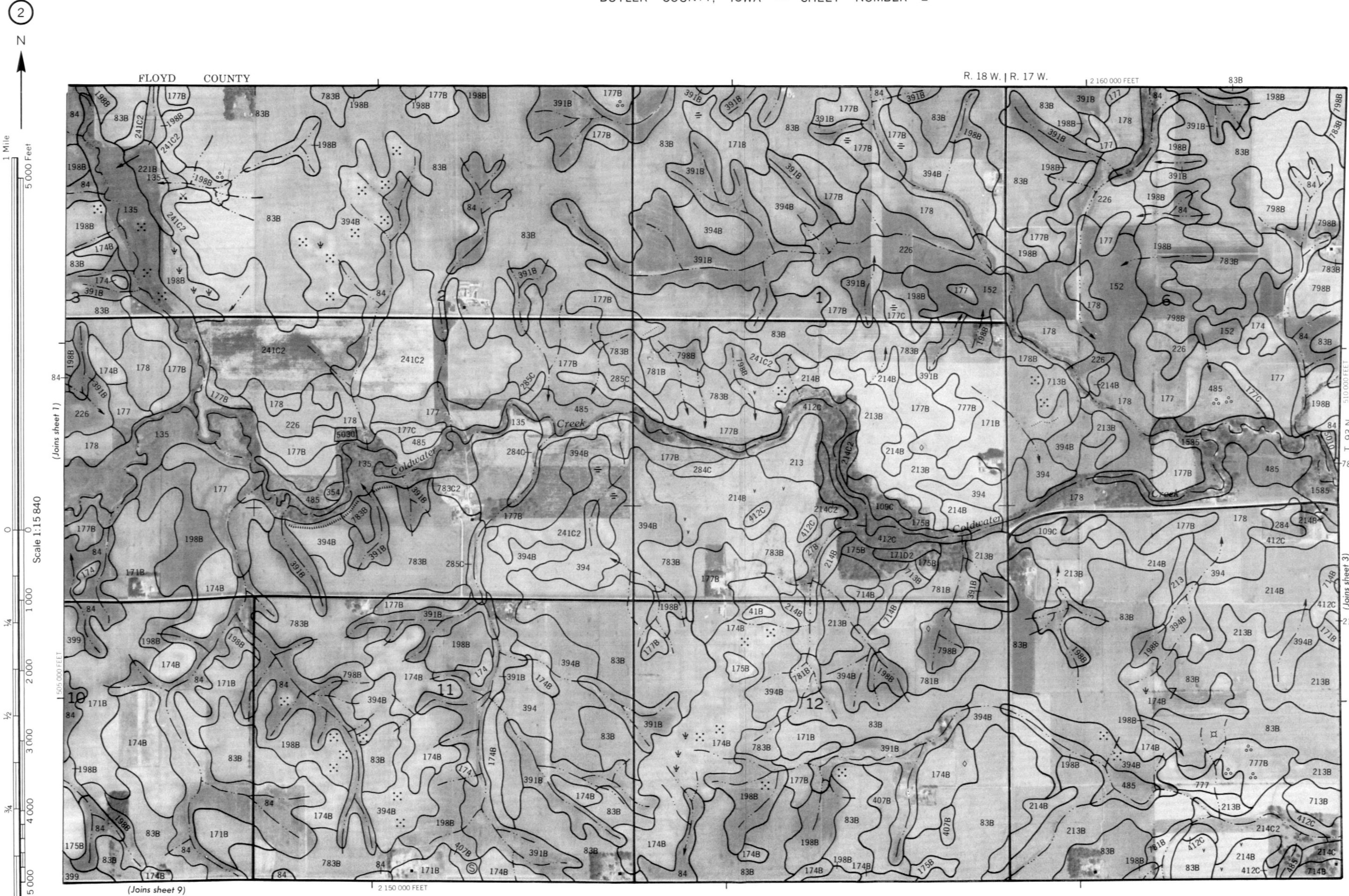
Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded and 3 that it is severely eroded.

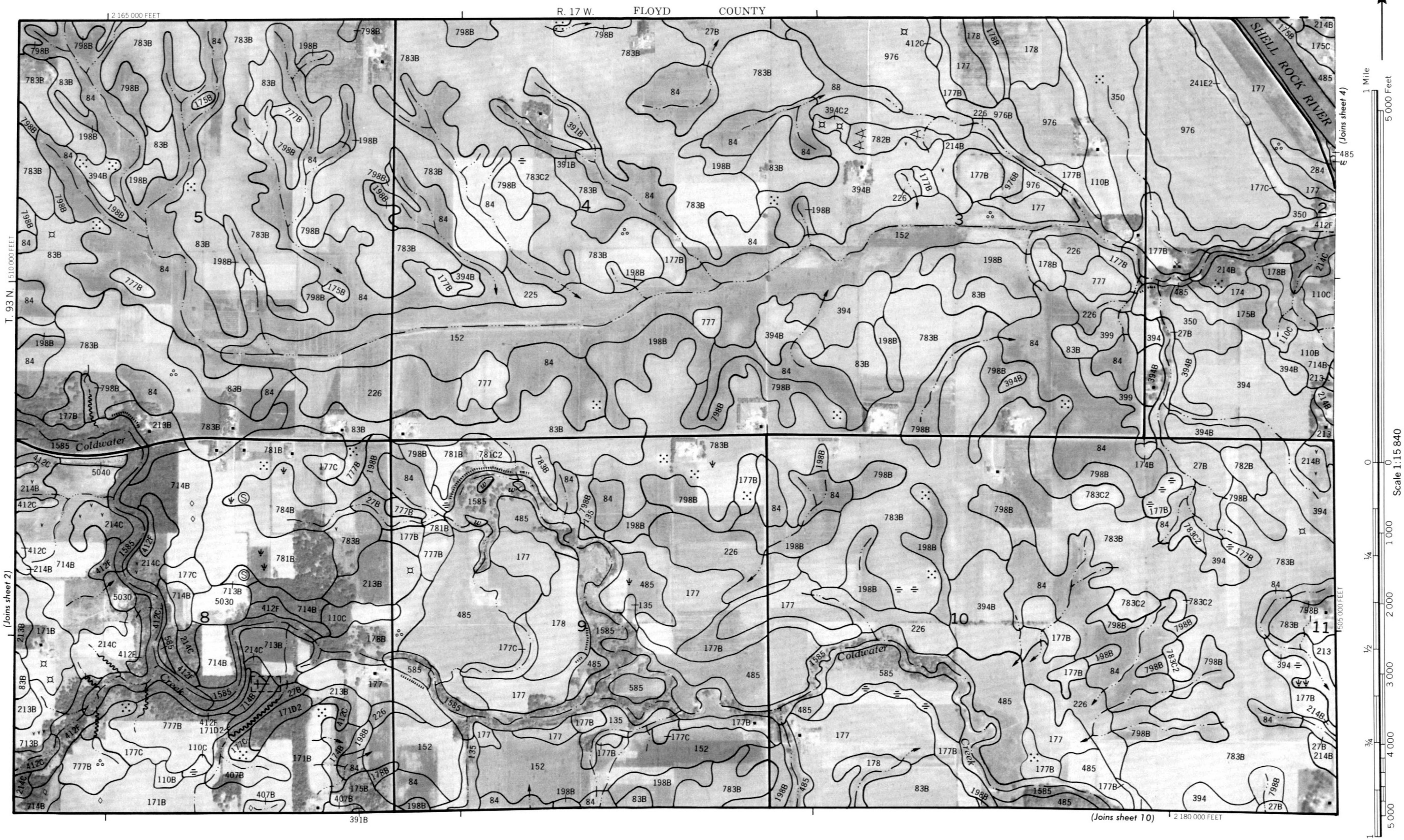
SYMBOL	NAME
11B	Colo-Ely complex, 2 to 5 percent slopes
27B	Terril loam, 2 to 5 percent slopes
41B	Sparta loamy fine sand, 1 to 5 percent slopes
41C	Sparta loamy fine sand, 5 to 9 percent slopes
41D	Sparta loamy fine sand, 9 to 14 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes
63C	Chelsea loamy fine sand, 2 to 9 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
83C	Kenyon loam, 5 to 9 percent slopes
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded
83D2	Kenyon loam, 9 to 14 percent slopes, moderately eroded
84	Clyde silty clay loam, 0 to 3 percent slopes
88	Nevin silty clay loam, 0 to 2 percent slopes
109C	Backbone fine sandy loam, 2 to 9 percent slopes
110B	Lamont fine sandy loam, 2 to 5 percent slopes
110C	Lamont fine sandy loam, 5 to 9 percent slopes
118	Garwin silty clay loam, 0 to 2 percent slopes
119	Muscatine silty clay loam, 1 to 3 percent slopes
120	Tama silt loam, 0 to 2 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes
135	Coland clay loam, 0 to 2 percent slopes
150B	Hanska loam, 1 to 4 percent slopes
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
153	Shandep clay loam, 0 to 1 percent slopes
162C	Downs silt loam, 5 to 9 percent slopes
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded
171	Bassett loam, 0 to 2 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded
171F	Bassett loam, 14 to 25 percent slopes
173	Hoopeston fine sandy loam, 0 to 2 percent slopes
173B	Hoopeston fine sandy loam, 2 to 5 percent slopes
174	Bolan loam, 0 to 2 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
174C2	Bolan loam, 5 to 9 percent slopes, moderately eroded
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
175C	Dickinson fine sandy loam, 5 to 9 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
177C	Saude loam, 5 to 9 percent slopes
178	Waukee loam, 0 to 2 percent slopes
178B	Waukee loam, 2 to 5 percent slopes
184	Klinger silty clay loam, 1 to 3 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
201B	Coland-Terril complex, 1 to 4 percent slopes
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
214C	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes
214C2	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded
221B	Palms muck, 2 to 5 percent slopes
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
241C2	Saude-Burkhardt complex, 2 to 9 percent slopes, moderately eroded
241E2	Saude-Burkhardt complex, 9 to 18 percent slopes, moderately eroded
284	Flagler sandy loam, 0 to 2 percent slopes
284B	Flagler sandy loam, 2 to 5 percent slopes
284C	Flagler sandy loam, 5 to 9 percent slopes
285C	Burkhardt sandy loam, 2 to 9 percent slopes
350	Waukegan silt loam, 0 to 2 percent slopes
354	Aquolls, ponded
377B	Dinsdale silty clay loam, 2 to 5 percent slopes
377C2	Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded
382	Maxfield silty clay loam, 0 to 2 percent slopes
391B	Clyde-Floyd complex, 1 to 4 percent slopes
394	Ostrander loam, 0 to 2 percent slopes
394B	Ostrander loam, 2 to 5 percent slopes
394C	Ostrander loam, 5 to 9 percent slopes
394C2	Ostrander loam, 5 to 9 percent slopes, moderately eroded
398	Tripoli silty clay loam, 0 to 2 percent slopes
399	Readlyn silty clay loam, 1 to 3 percent slopes
404	Thorp silt loam, 0 to 1 percent slopes
407B	Schley silt loam, 1 to 4 percent slopes
408B	Olin fine sandy loam, 2 to 5 percent slopes
408C	Olin fine sandy loam, 5 to 9 percent slopes
412C	Sogn loam, 2 to 9 percent slopes
412F	Sogn loam, 9 to 30 percent slopes
428B	Ely silt loam, 2 to 5 percent slopes
430	Ackmore silt loam, 1 to 3 percent slopes
457	Du Page loam, 0 to 2 percent slopes
485	Spillville loam, 0 to 2 percent slopes
585	Spillville-Coland complex, 0 to 2 percent slopes
621	Houghton muck, 0 to 2 percent slopes
662D	Mt. Carroll silt loam, 9 to 14 percent slopes
662D3	Mt. Carroll silt loam, 9 to 14 percent slopes, severely eroded
662F	Mt. Carroll silt loam, 14 to 25 percent slopes
662F3	Mt. Carroll silt loam, 14 to 25 percent slopes, severely eroded
713B	Winneshiek loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
714B	Winneshiek loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
733	Calco silty clay loam, 0 to 2 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
777	Wapsie loam, 0 to 2 percent slopes
777B	Wapsie loam, 2 to 5 percent slopes
781B	Lourdes loam, 2 to 5 percent slopes
781C2	Lourdes loam, 5 to 9 percent slopes, moderately eroded
782B	Donnan loam, 2 to 5 percent slopes
782C2	Donnan loam, 5 to 9 percent slopes, moderately eroded
783B	Cresco loam, 2 to 5 percent slopes
783C	Cresco loam, 5 to 9 percent slopes
783C2	Cresco loam, 5 to 9 percent slopes, moderately eroded
784B	Riceville loam, 1 to 4 percent slopes
798B	Protivin clay loam, 1 to 4 percent slopes
976	Raddle silt loam, 0 to 2 percent slopes
976B	Raddle silt loam, 2 to 5 percent slopes
981B	Worthen silt loam, 2 to 5 percent slopes
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes
5010	Pits, sand and gravel
5030	Pits, limestone
5040	Orthents, loamy

BUTLER COUNTY, IOWA — SHEET NUMBER 1

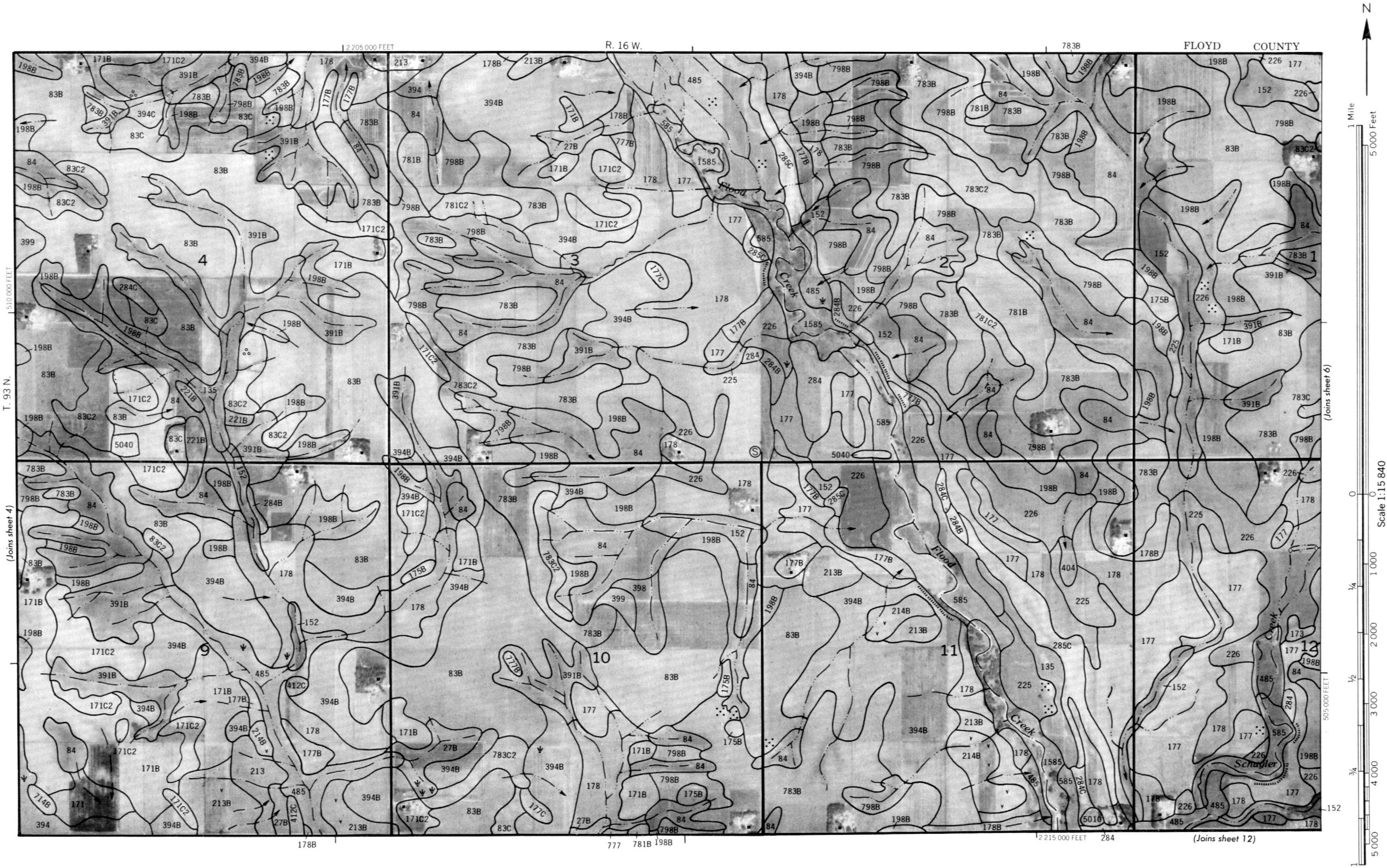


BUTLER COUNTY, IOWA — SHEET NUMBER 2

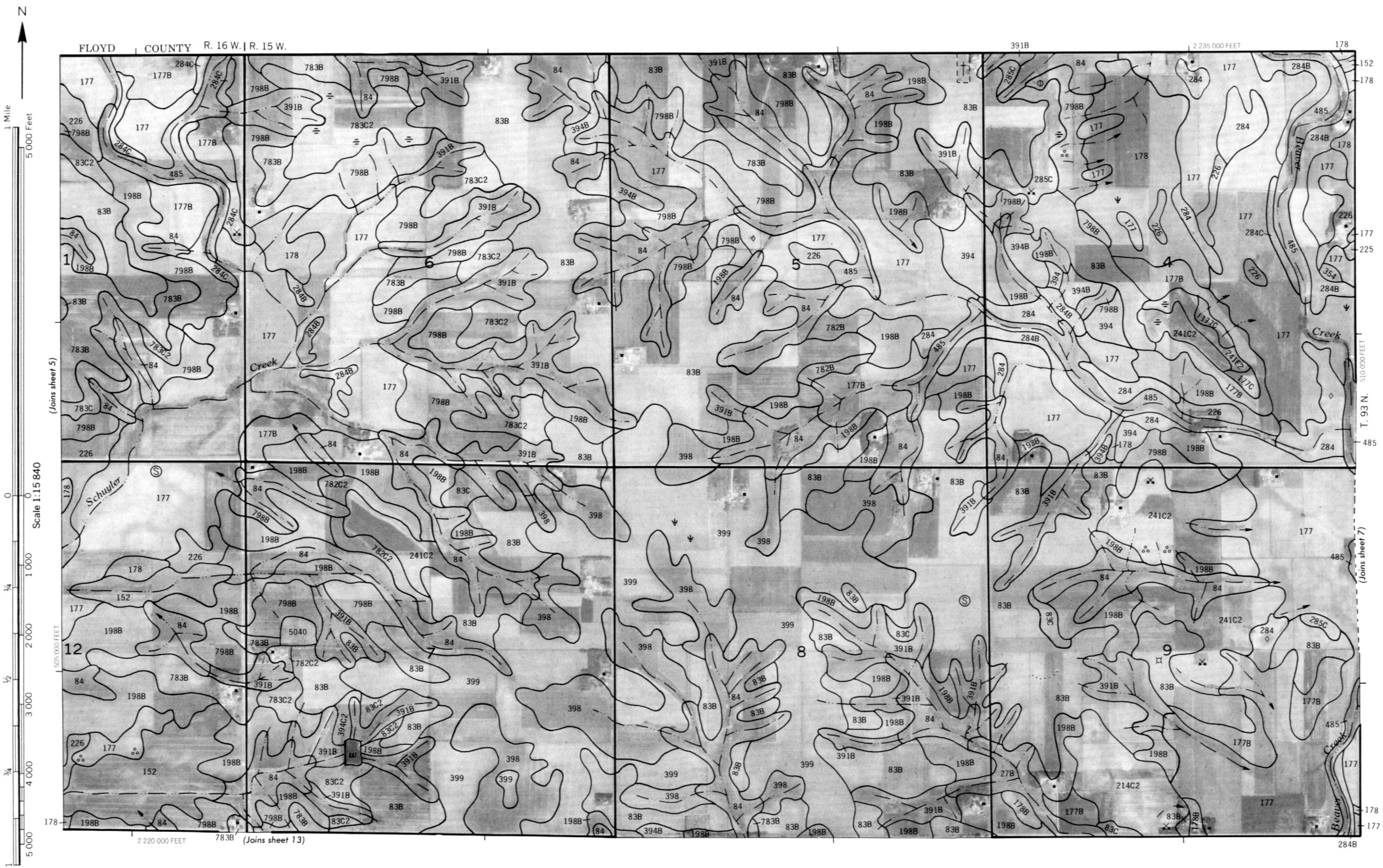



N
R. 17 W.
FLOYD COUNTY
SHELL ROCK RIVER
(Joins sheet 4)
(Joins sheet 2)
(Joins sheet 10)
T. 93 N.
2 165 000 FEET
2 180 000 FEET
510 000 FEET
505 000 FEET
Coldwater
Creek
Coldwater
Creek
1 Mile
5 000 Feet
Scale 1:15 840

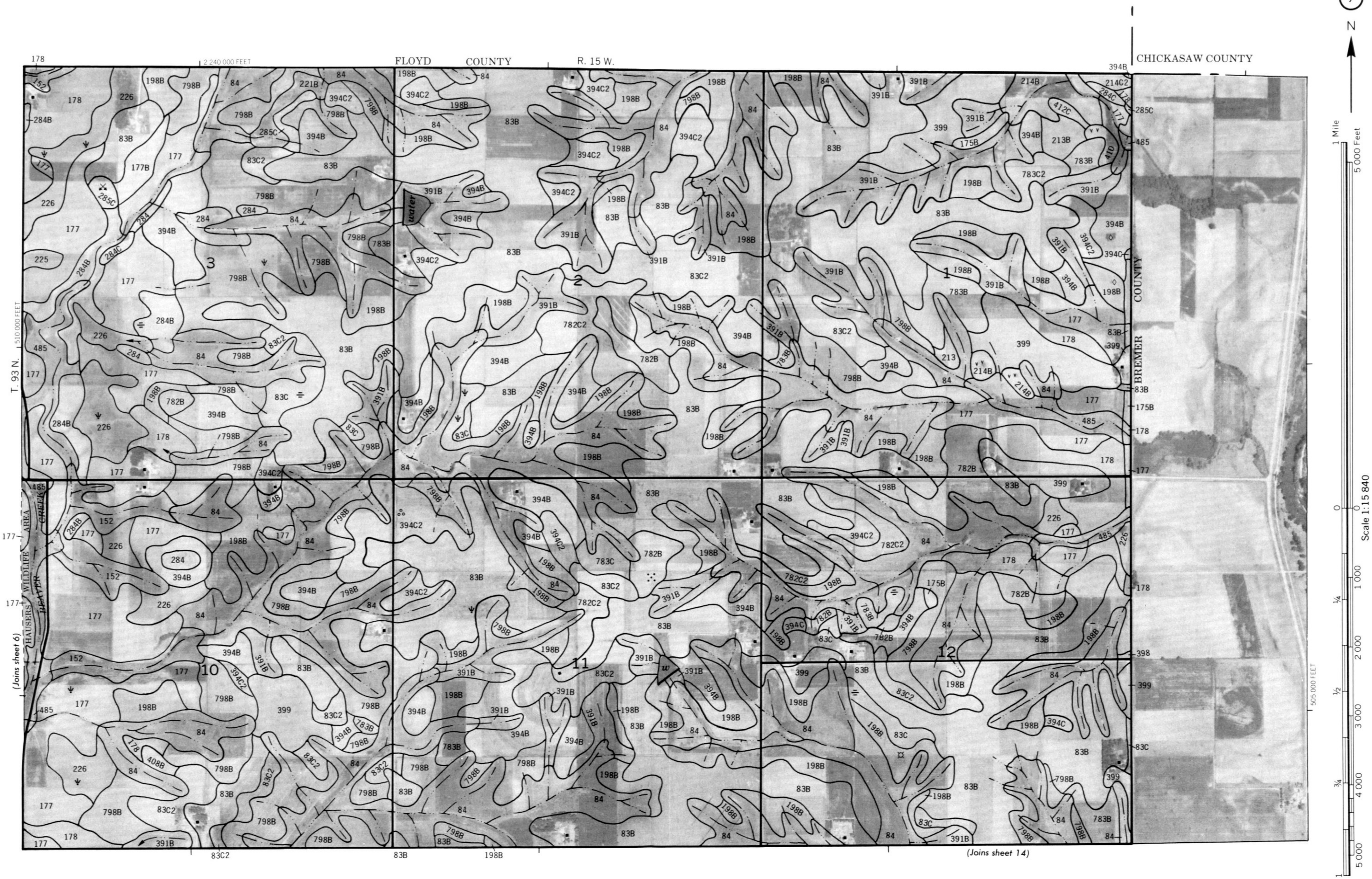
BUTLER COUNTY, IOWA — SHEET NUMBER 4

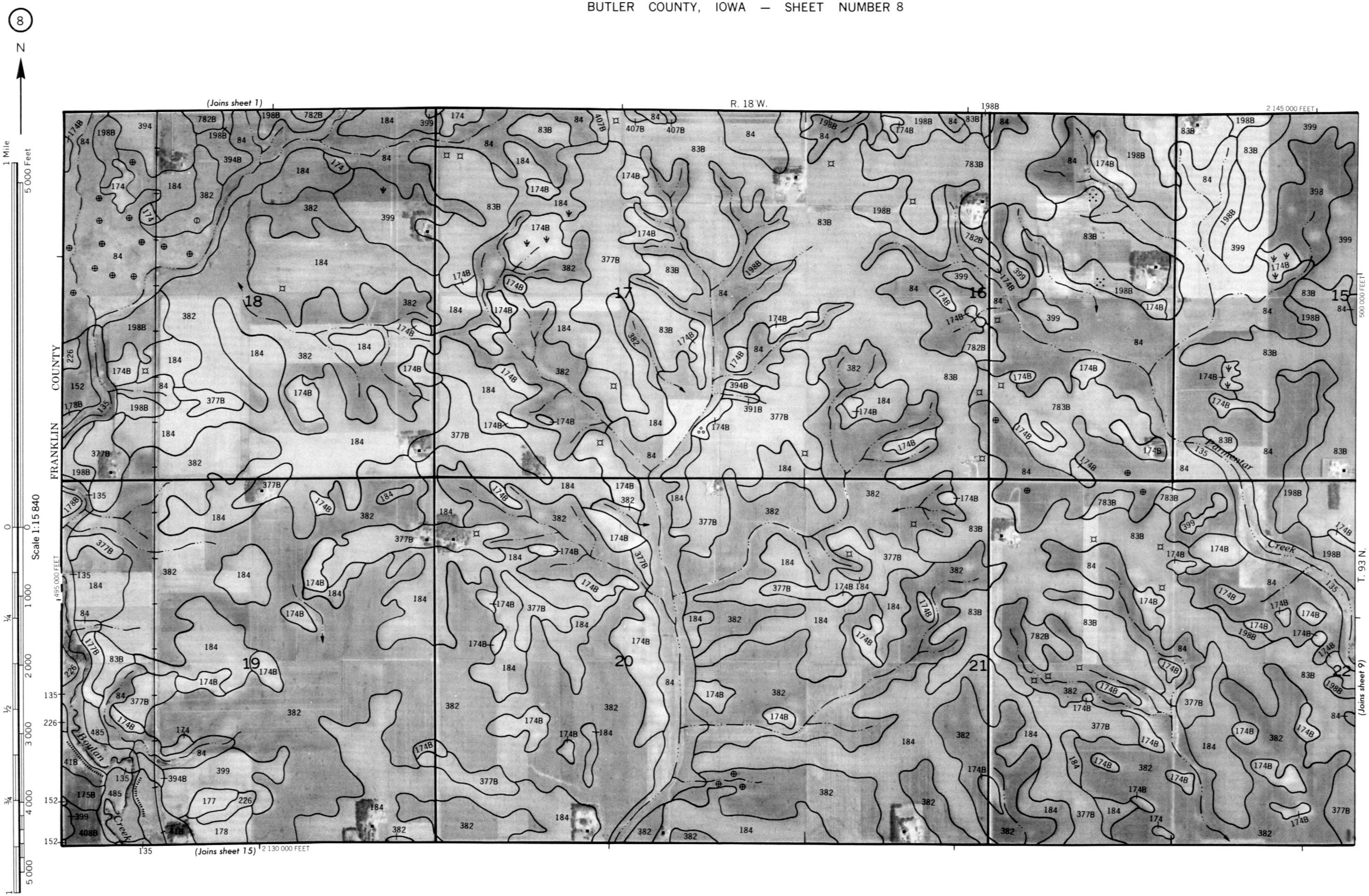

N
R. 16 W.
T. 93 N.
FLOYD COUNTY
2 205 000 FEET
2 215 000 FEET
510 000 FEET
505 000 FEET
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
Flood Creek
Schuyler Creek
1
2
3
4
9
10
11
12
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

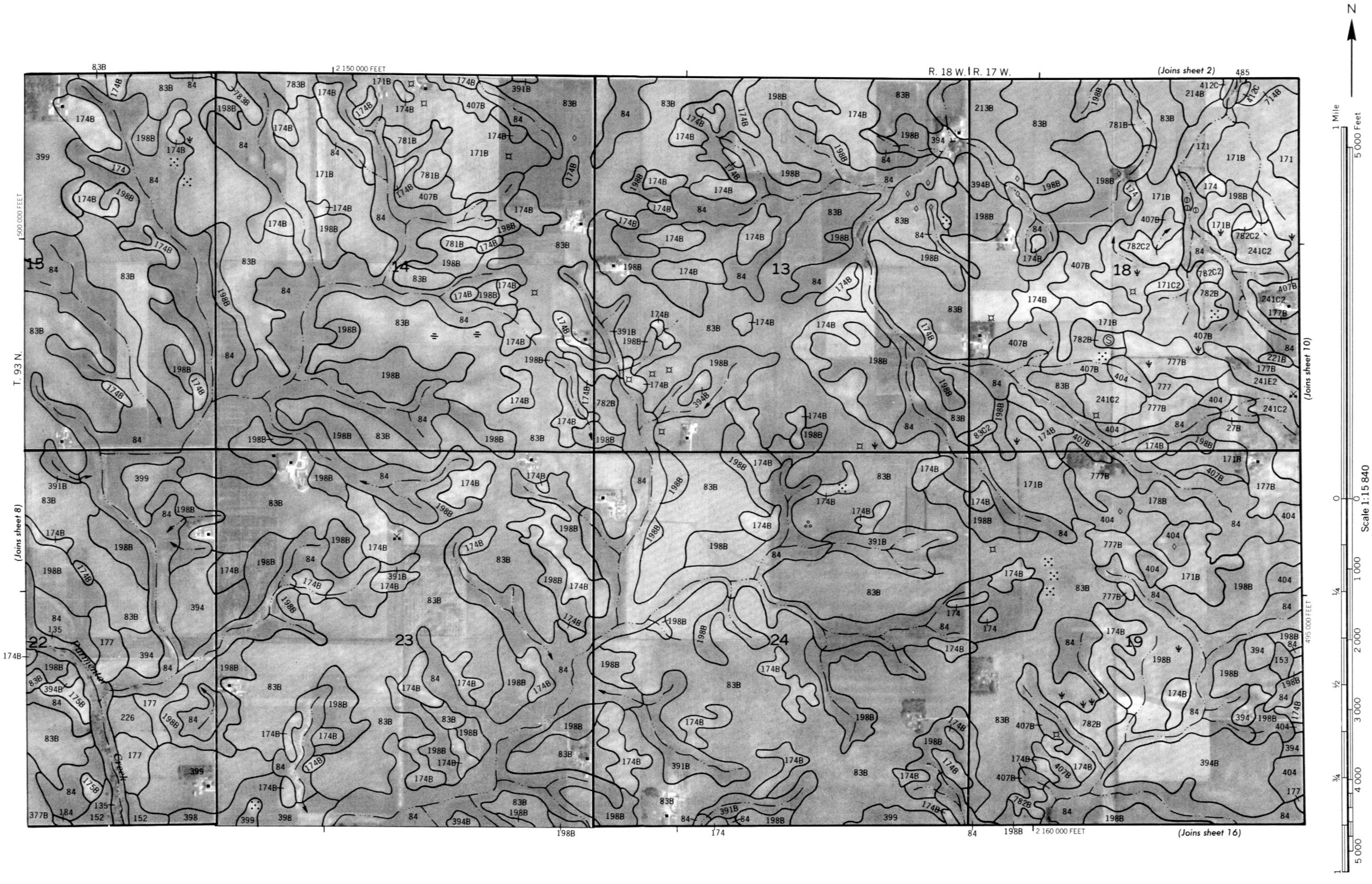
BUTLER COUNTY, IOWA — SHEET NUMBER 6



BUTLER COUNTY, IOWA — SHEET NUMBER 7

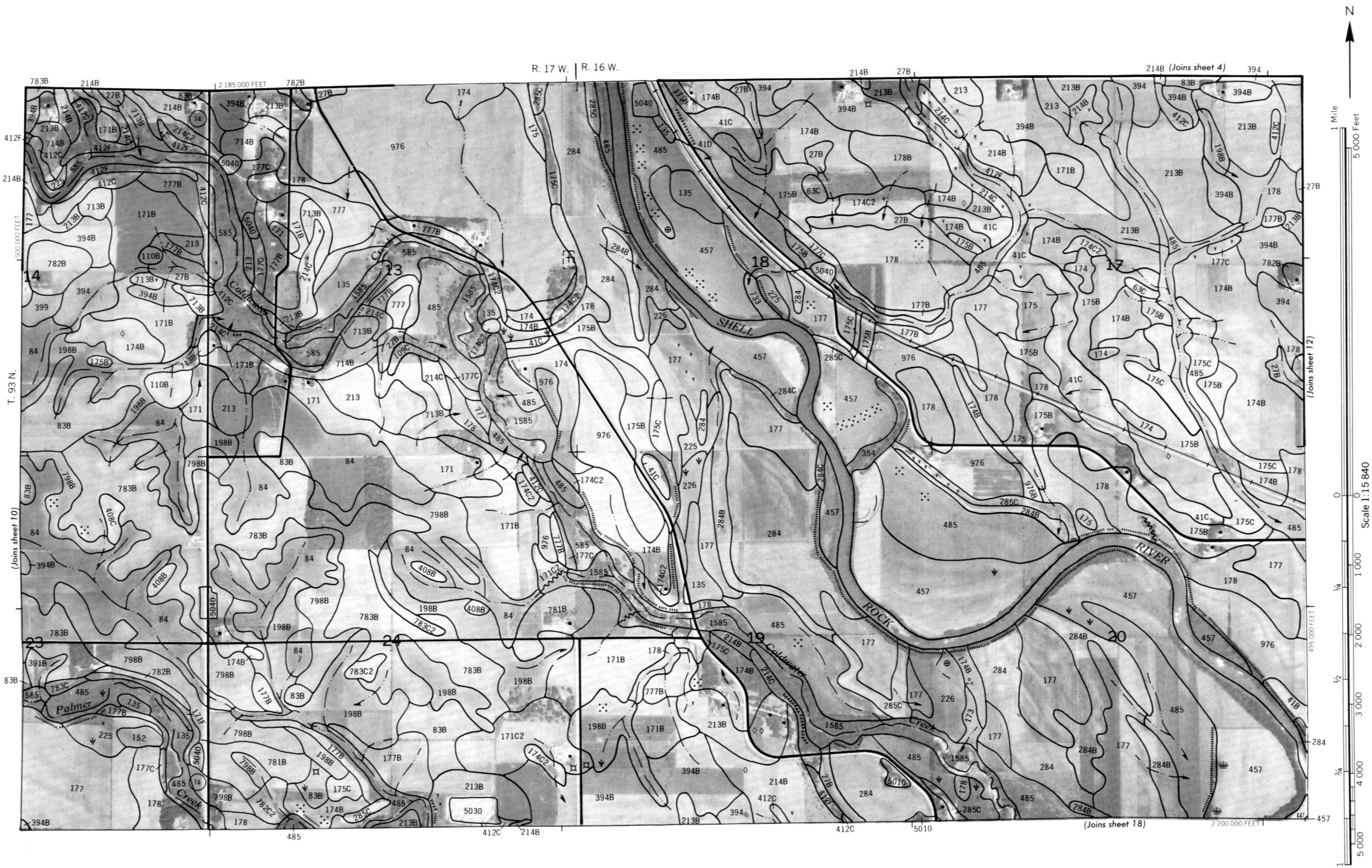


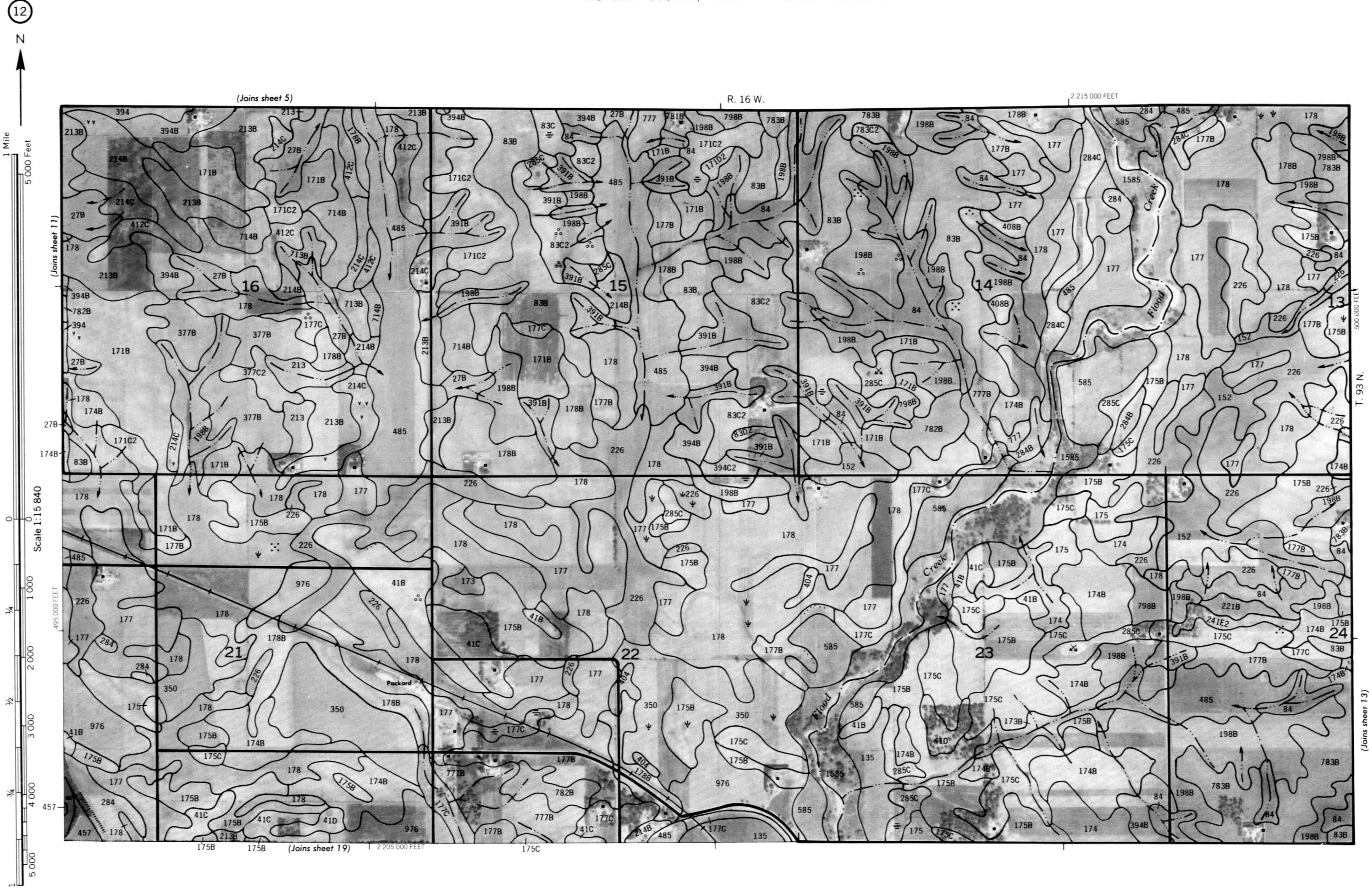

8
N
(Joins sheet 1)
R. 18 W.
2 145 000 FEET
500 000 FEET
T. 93 N.
(Joins sheet 9)
(Joins sheet 15)
2 130 000 FEET
495 000 FEET
FRANKLIN COUNTY
Scale 1:15 840
1 Mile
5 000 Feet
1 000
2 000
3 000
4 000
5 000
¼
½
¾
0
1
15
16
17
18
19
20
21
22
Parmentar Creek
Boylan Creek

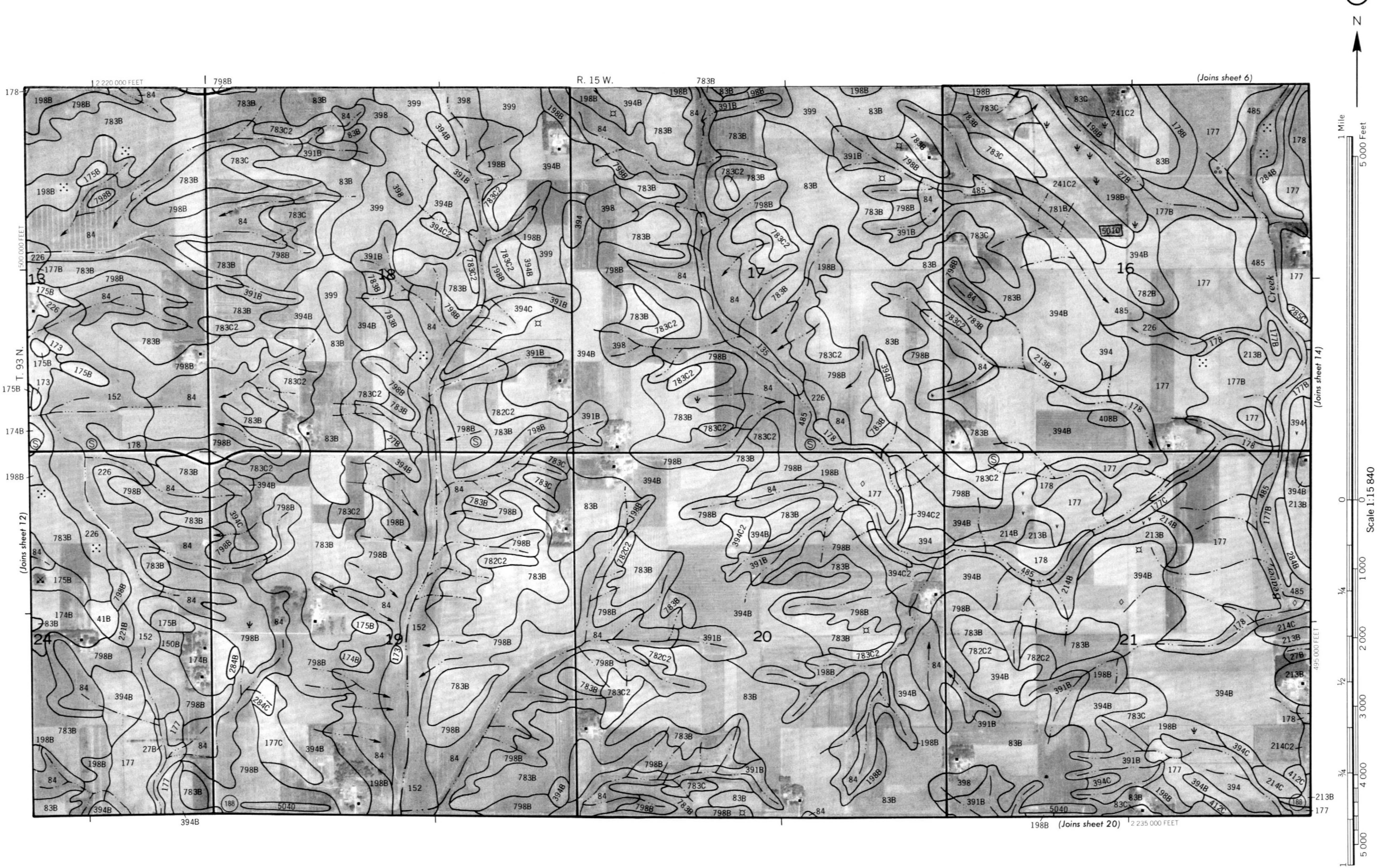

N
2 150 000 FEET
R. 18 W. | R. 17 W.
(Joins sheet 2)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
500 000 FEET
495 000 FEET
2 160 000 FEET
T. 93 N.
15
14
13
18
22
23
24
19
Pumpkin Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


10
N
(Joins sheet 3)
R. 17 W.
2 180 000 FEET
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
2 165 000 FEET
T. 93 N.
500 000 FEET
495 000 FEET
Coldwater
Creek
Palmer
Creek
14
15
16
17
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000
¼
½
¾

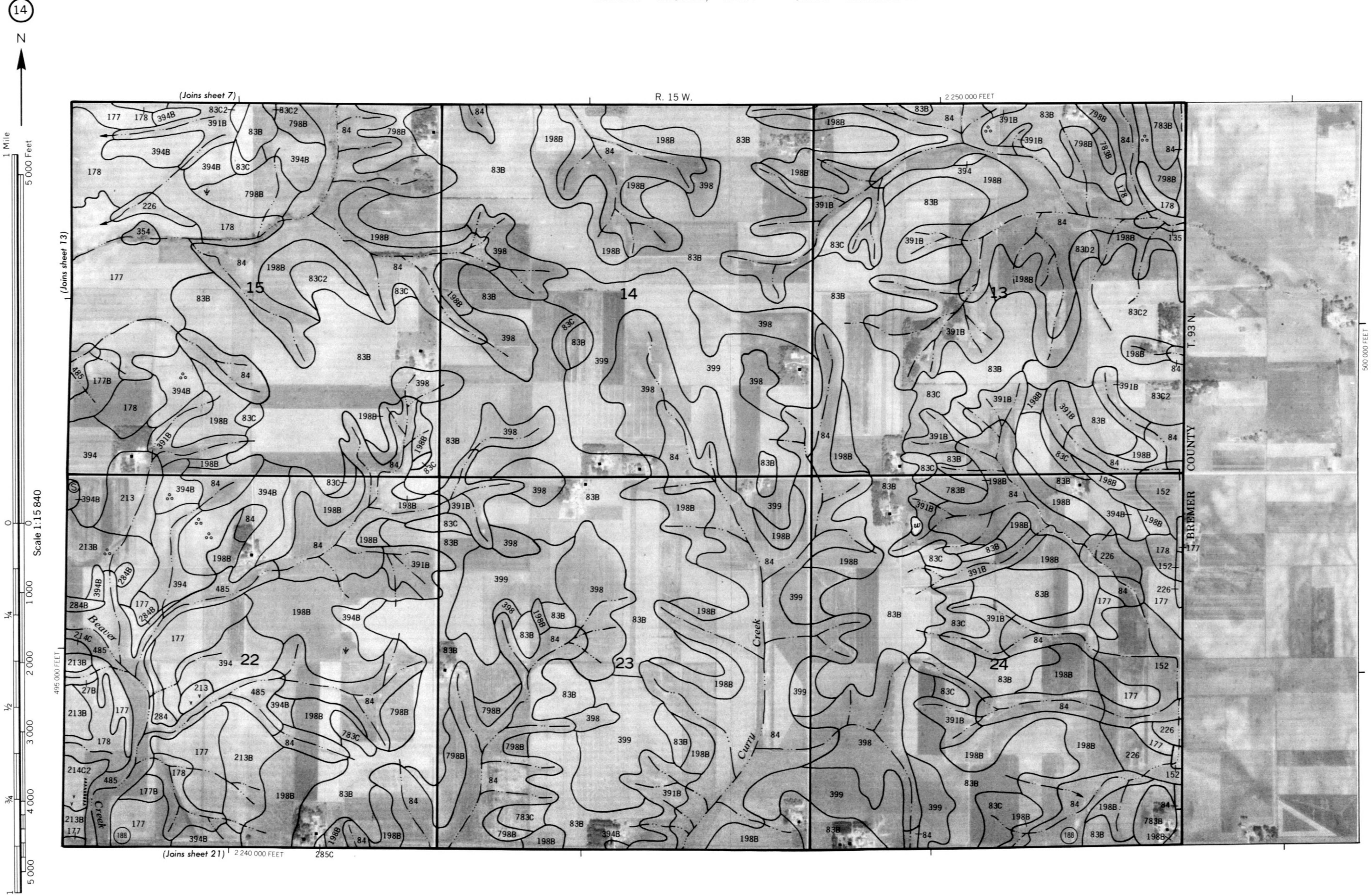
11

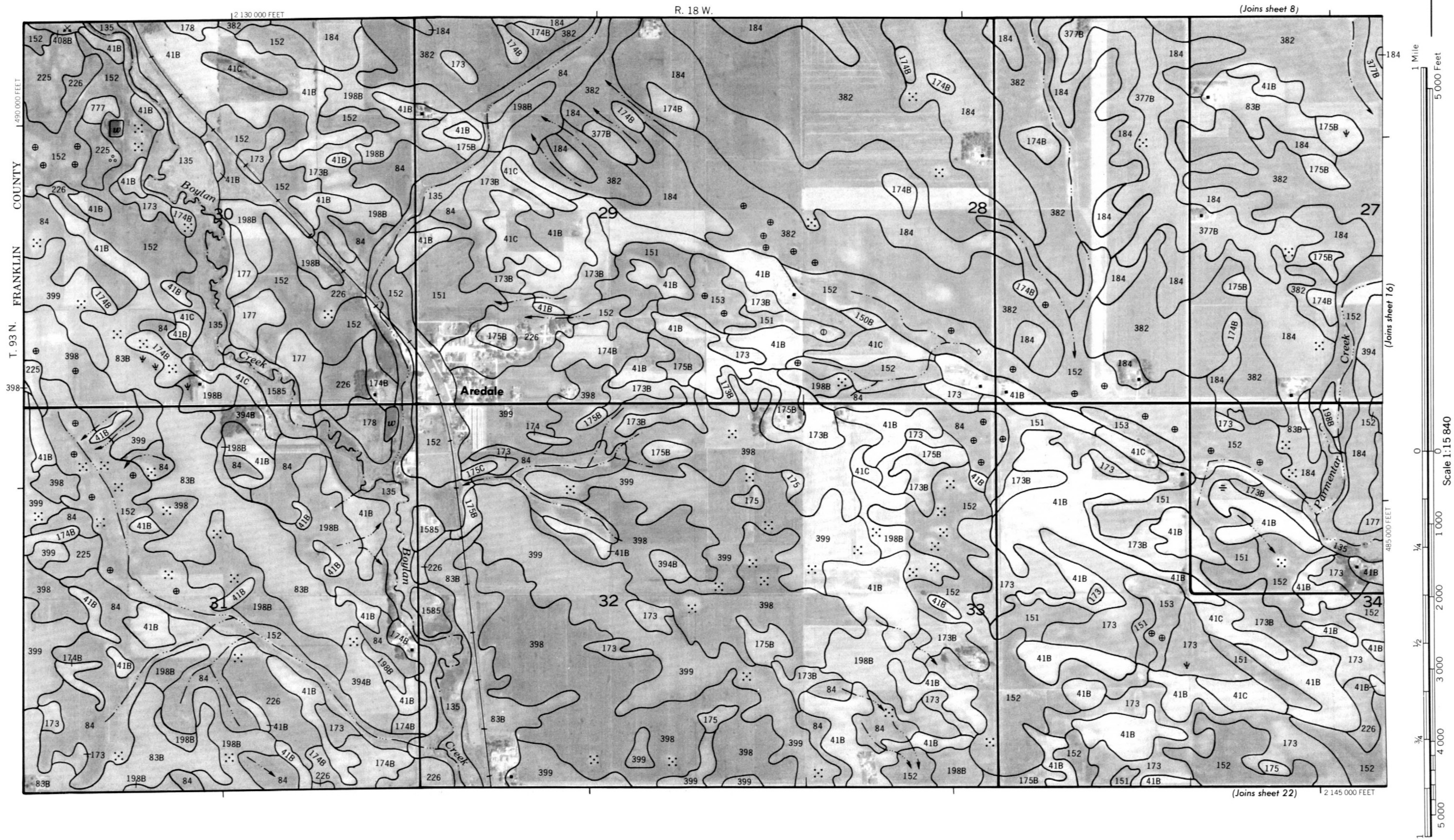

N
R. 17 W.
R. 16 W.
T. 93 N.
2 185 000 FEET
500 000 FEET
495 000 FEET
2 200 000 FEET
(Joins sheet 4)
(Joins sheet 12)
(Joins sheet 18)
(Joins sheet 10)
SHELL
ROCK
RIVER
Coldwater
Creek
Palmer
Creek
13
14
17
18
19
20
23
24
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

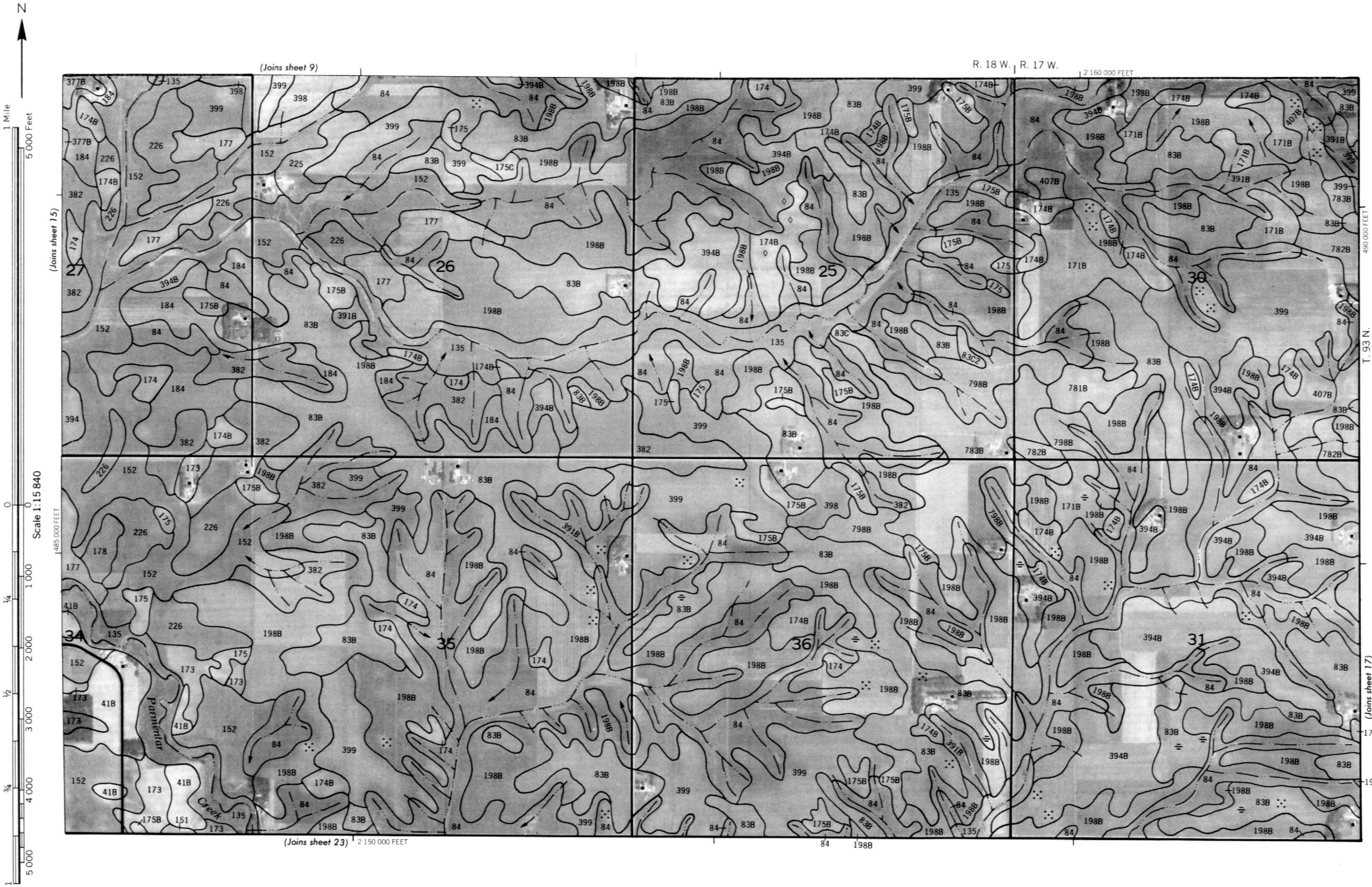

12
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 5)
R. 16 W.
2 215 000 FEET
(Joins sheet 11)
T. 93 N.
500 000 FEET
495 000 FEET
(Joins sheet 13)
(Joins sheet 19)
2 205 000 FEET
Packard
Flood Creek
16
15
14
13
21
22
23
24

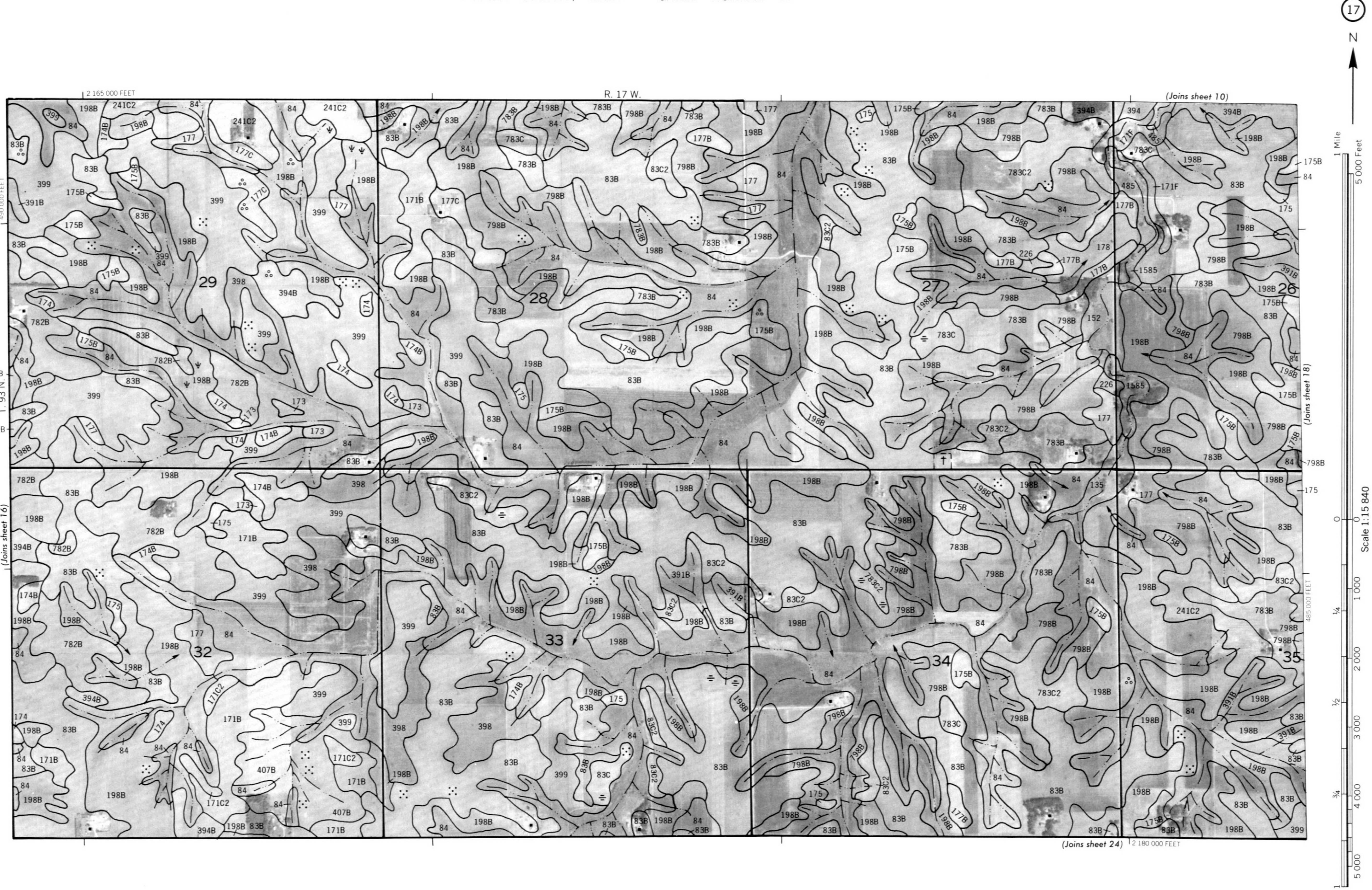

13
N
R. 15 W.
T. 93 N.
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
2 220 000 FEET
2 235 000 FEET
500 000 FEET
495 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
18
17
16
13
19
20
21
24

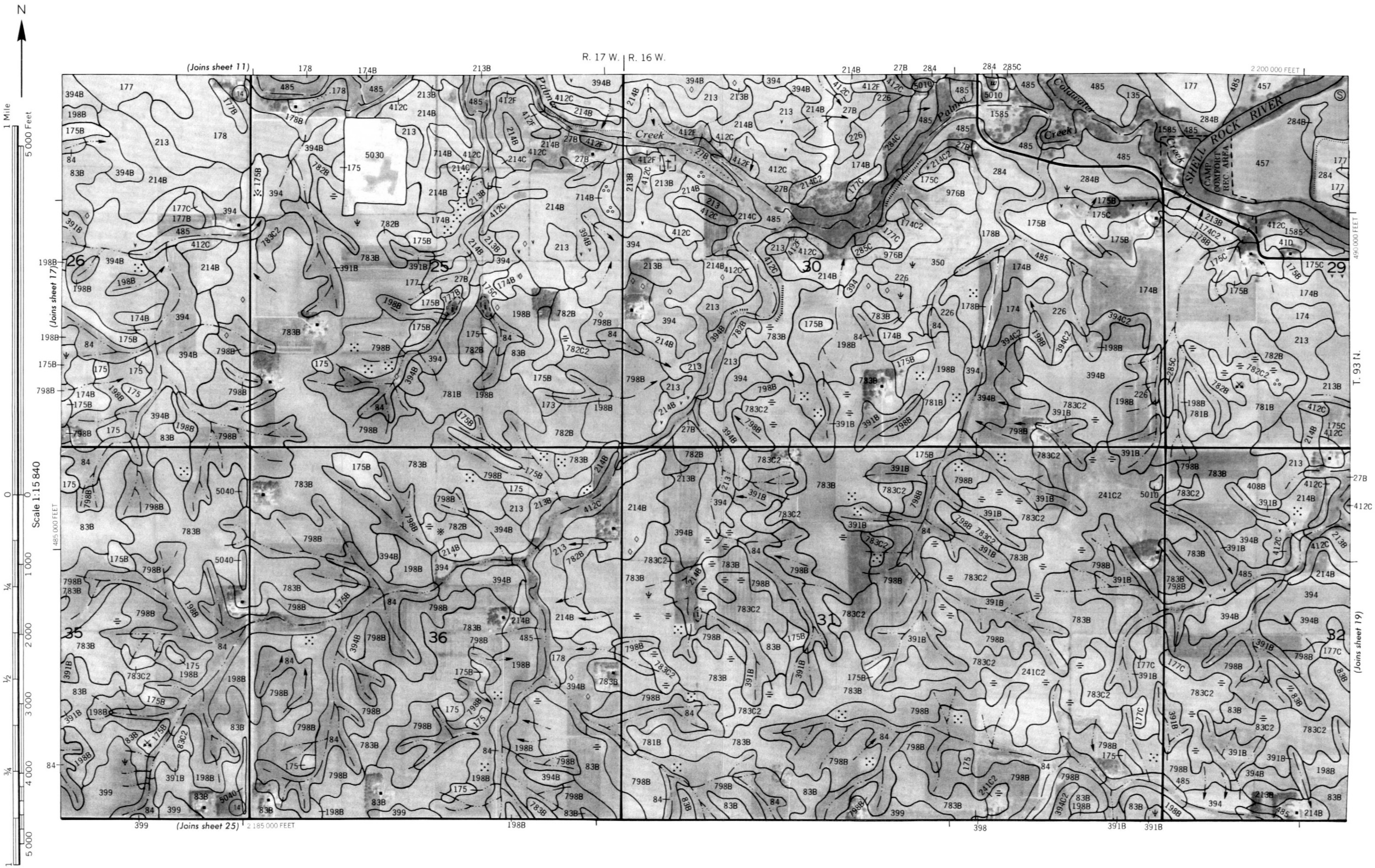
BUTLER COUNTY, IOWA — SHEET NUMBER 14



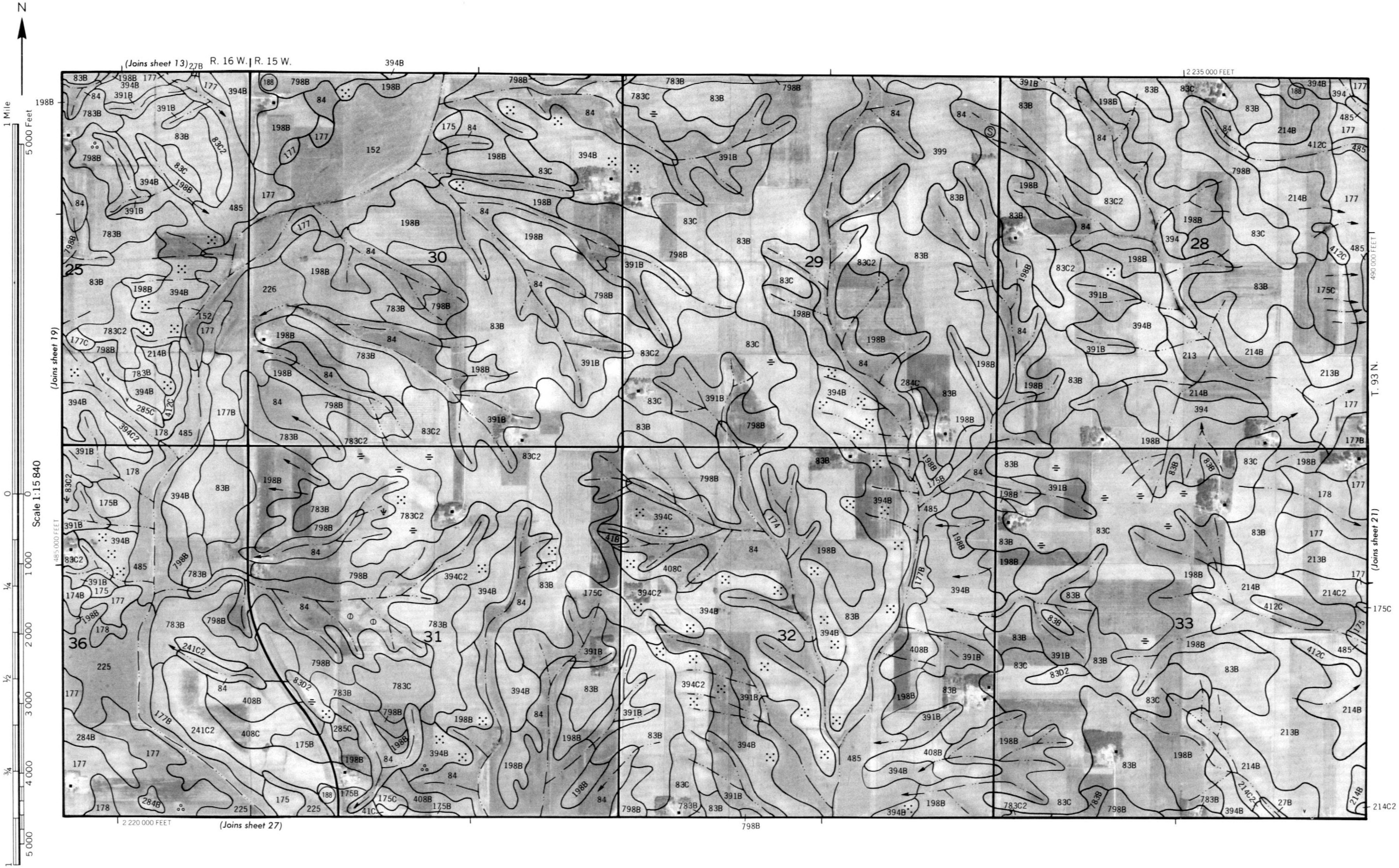

N
R. 18 W.
(Joins sheet 8)
(Joins sheet 16)
(Joins sheet 22)
2 130 000 FEET
2 145 000 FEET
490 000 FEET
485 000 FEET
FRANKLIN COUNTY
T. 93 N.
Aredale
Boylan Creek
Parmenter Creek
29
30
28
27
31
32
33
34
1 Mile
5 000 Feet
Scale 1:15 840

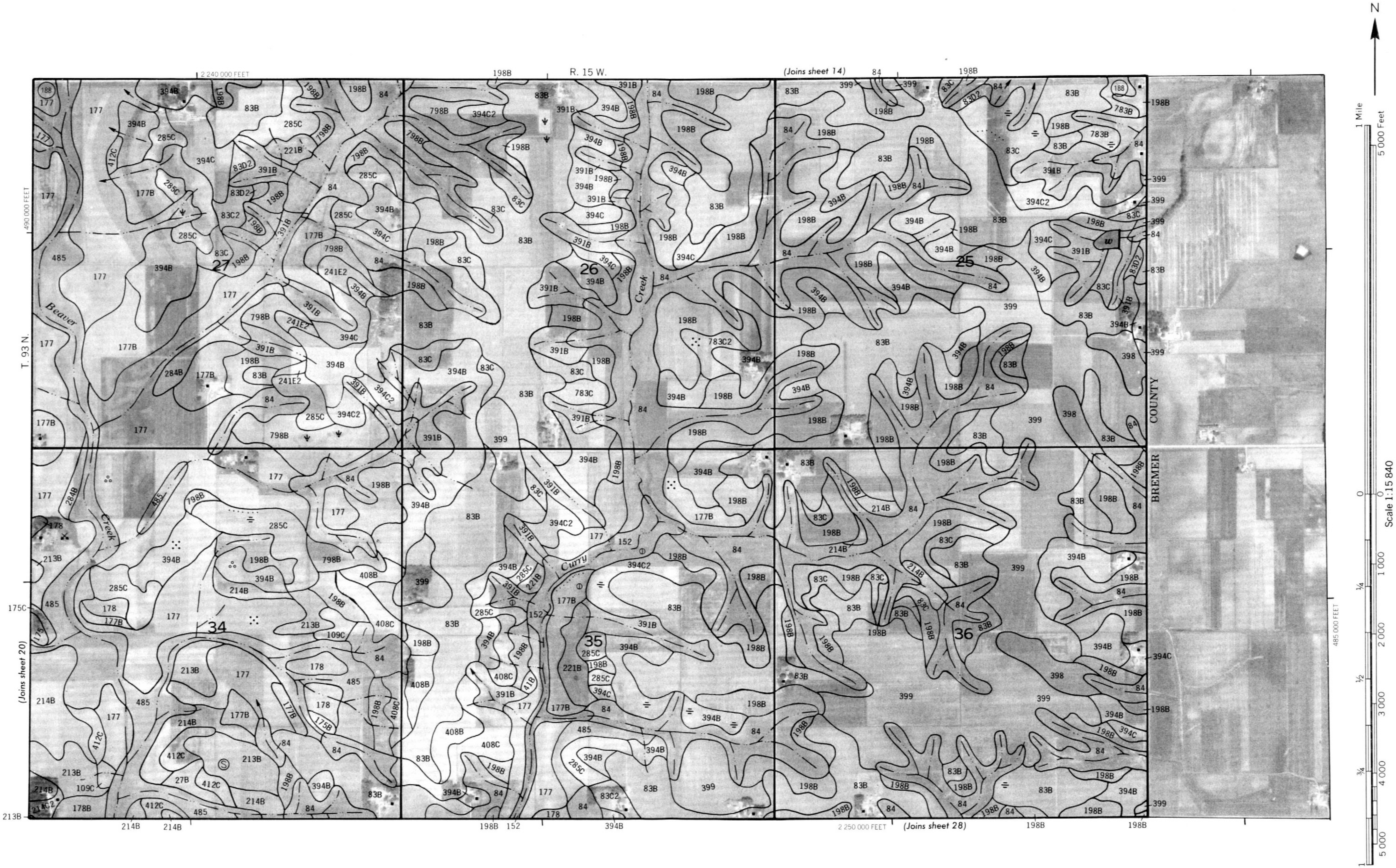

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 9)
R. 18 W.
R. 17 W.
2 160 000 FEET
490 000 FEET
T. 93 N.
(Joins sheet 15)
485 000 FEET
(Joins sheet 17)
(Joins sheet 23)
2 150 000 FEET
27
26
25
30
34
35
36
31
Parmentar Creek

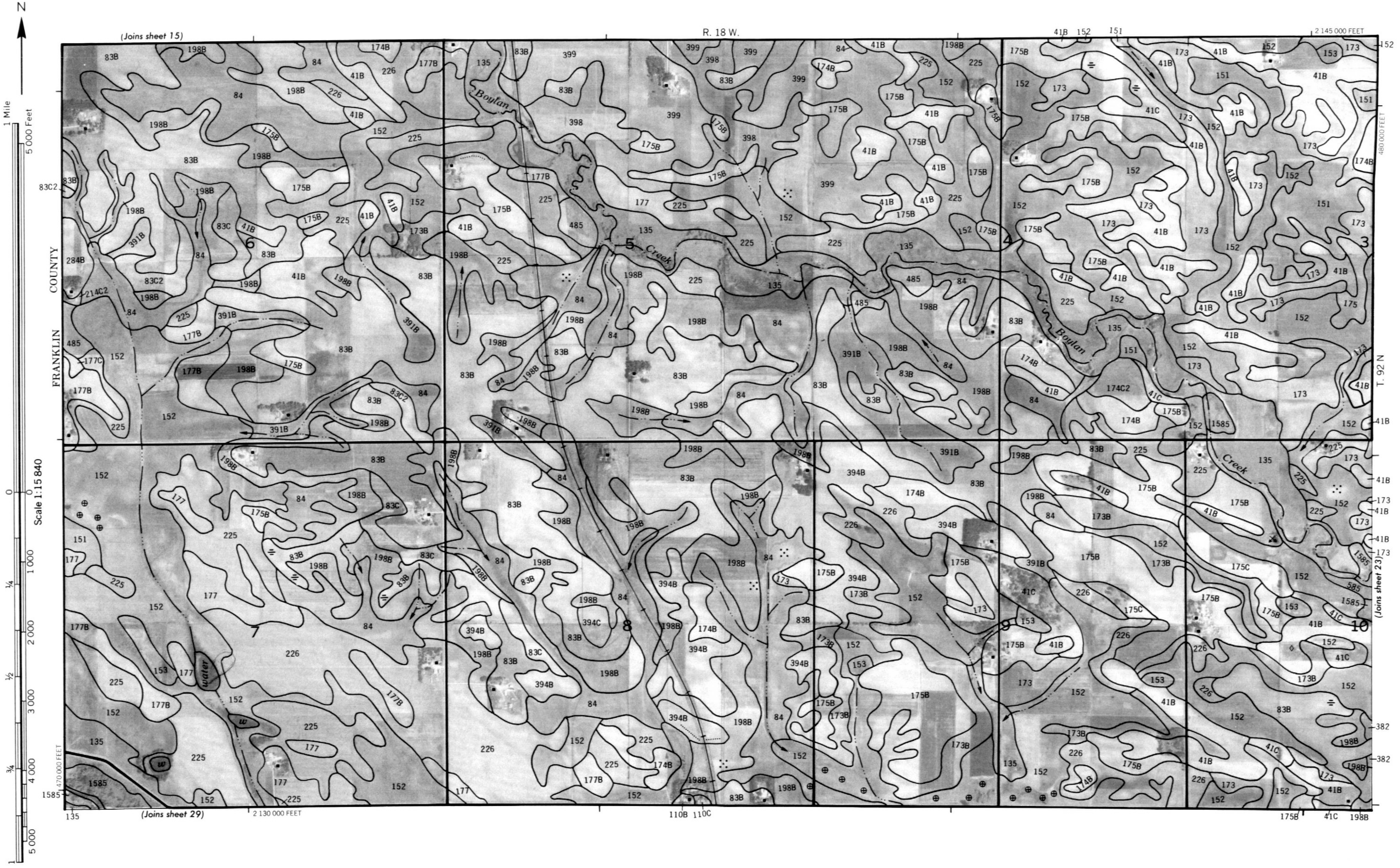

17
N
R. 17 W.
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
T. 93 N.
2 165 000 FEET
490 000 FEET
485 000 FEET
2 180 000 FEET
29
28
27
26
32
33
34
35
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
Scale 1:15 840

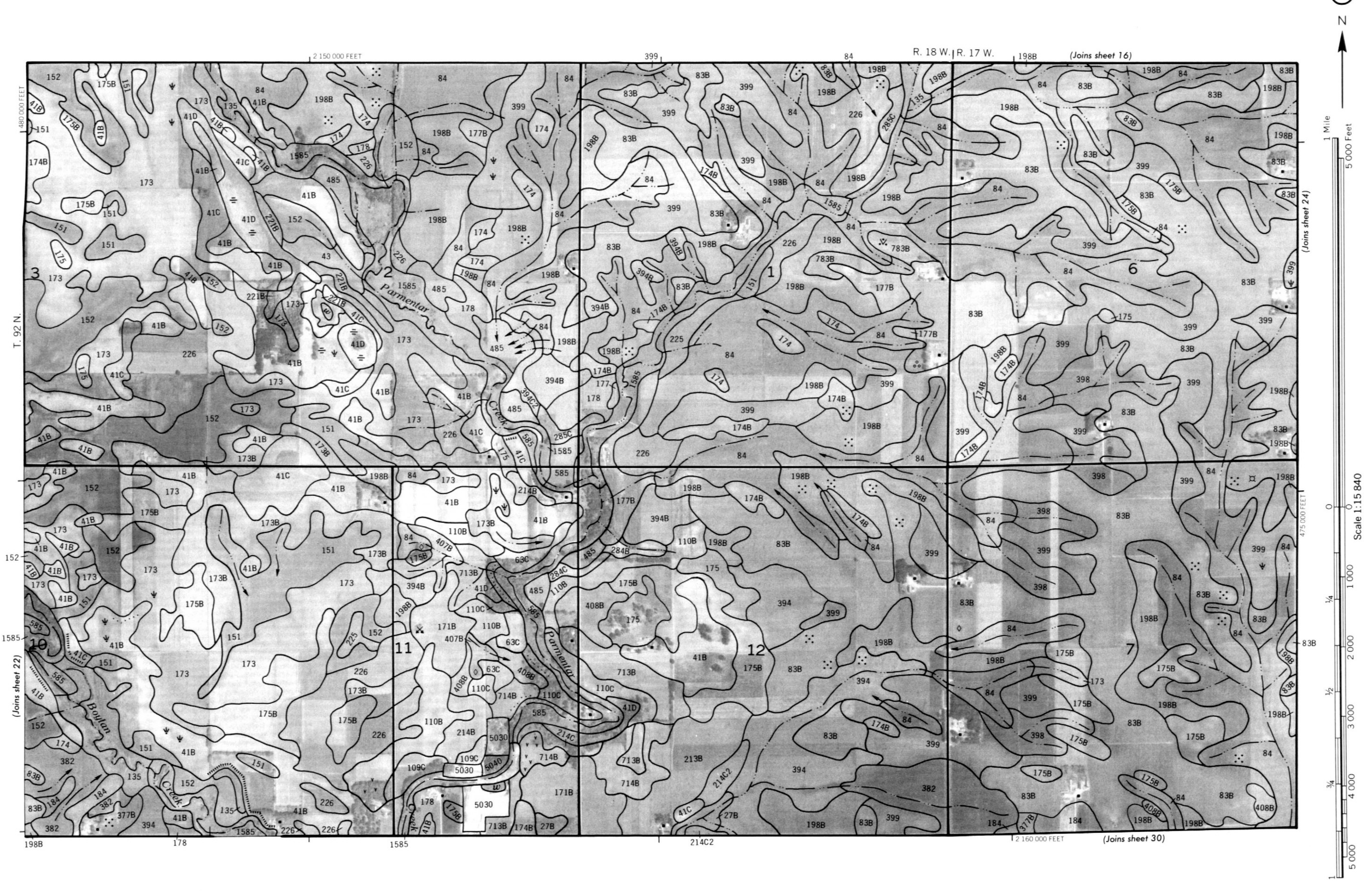

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 11)
R. 17 W.
R. 16 W.
2 200 000 FEET
Palmer Creek
Coldwater Creek
SHELL ROCK RIVER
CAMP COMFORT REC. AREA
T. 93 N.
490 000 FEET
(Joins sheet 17)
(Joins sheet 19)
485 000 FEET
(Joins sheet 25)
2 185 000 FEET
26
25
30
29
35
36
31
32


N
R. 16 W.
T. 93 N.
2 205 000 FEET
2 215 000 FEET
490 000 FEET
485 000 FEET
(Joins sheet 12)
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 18)
SHELL ROCK RIVER
Flood Creek
28
27
26
25
33
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

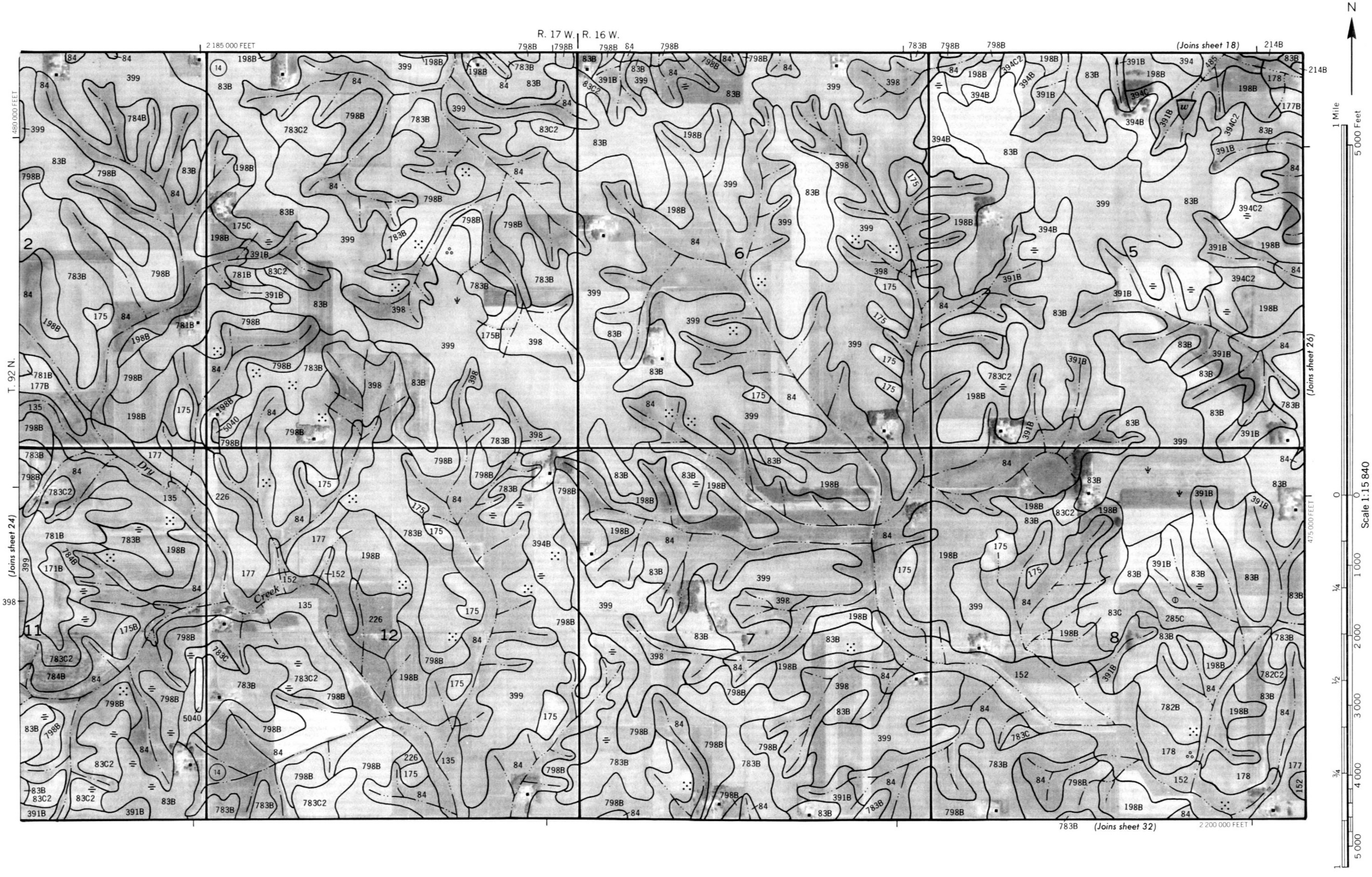

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 13)
R. 16 W.
R. 15 W.
2 235 000 FEET
490 000 FEET
485 000 FEET
2 220 000 FEET
T. 93 N.
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
25
30
29
28
36
31
32
33


N
R. 15 W.
(Joins sheet 14)
(Joins sheet 28)
(Joins sheet 20)
T. 93 N.
2 240 000 FEET
2 250 000 FEET
490 000 FEET
485 000 FEET
BREMER COUNTY
Beaver Creek
Curry Creek
27
26
25
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

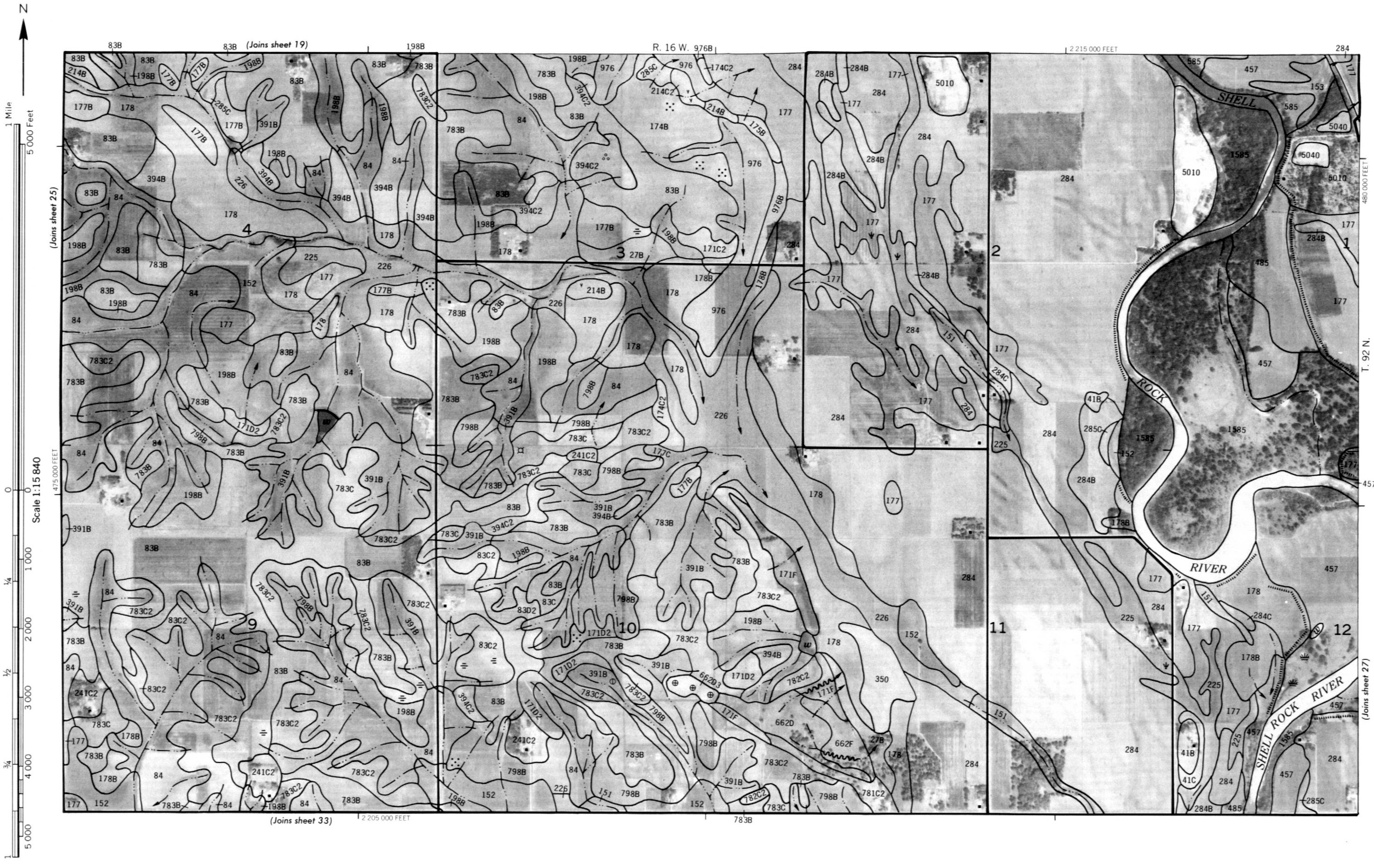

N
1 Mile
5 000 Feet
0
Scale 1:15 840
1 000
2 000
3 000
4 000
5 000
(Joins sheet 15)
R. 18 W.
2 145 000 FEET
480 000 FEET
FRANKLIN COUNTY
T. 92 N.
Boylan Creek
Boylan
Creek
water
w
(Joins sheet 23)
(Joins sheet 29)
2 130 000 FEET
470 000 FEET
6
5
4
3
7
8
9
10

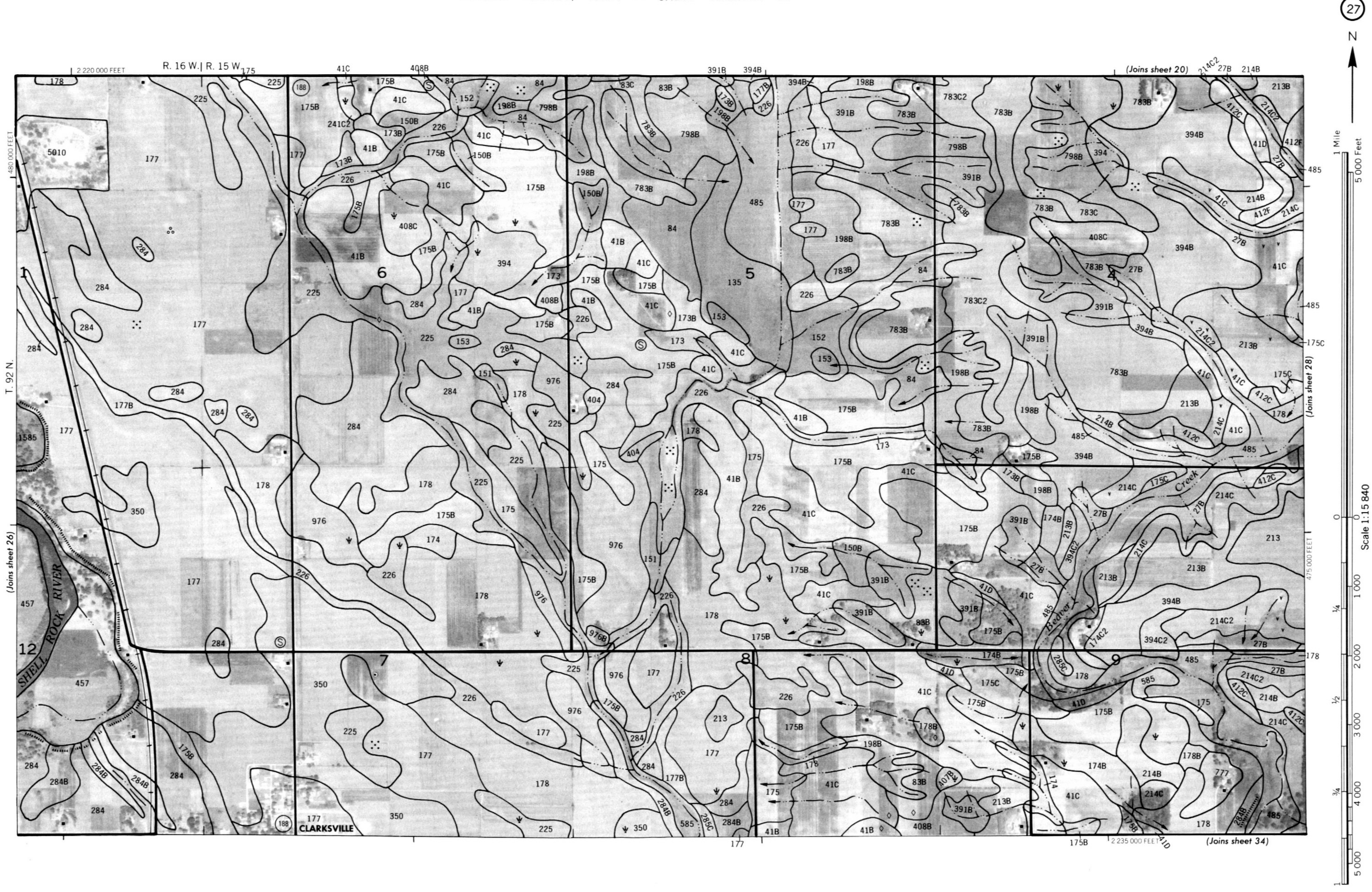

N
(Joins sheet 16)
(Joins sheet 24)
(Joins sheet 30)
(Joins sheet 22)
R. 18 W. | R. 17 W.
T. 92 N.
2 150 000 FEET
2 160 000 FEET
480 000 FEET
475 000 FEET
Parmentar Creek
Boylan Creek
1 Mile
5 000 Feet
Scale 1:15 840

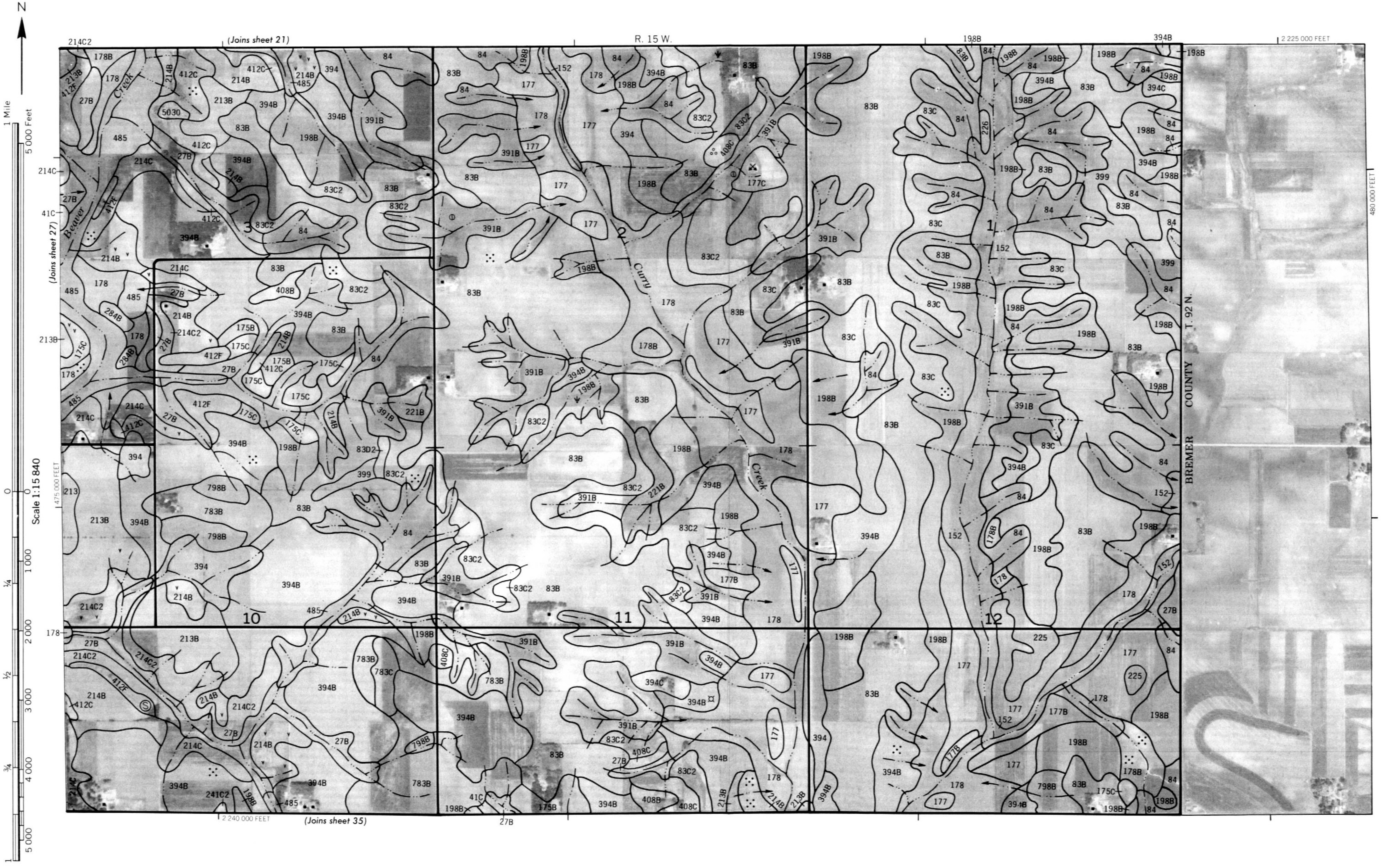

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 17)
R. 17 W.
2 180 000 FEET
480 000 FEET
475 000 FEET
T. 92 N.
(Joins sheet 23)
(Joins sheet 25)
2 165 000 FEET
(Joins sheet 31)
Creek
Dailu
5
4
3
2
8
9
10
11

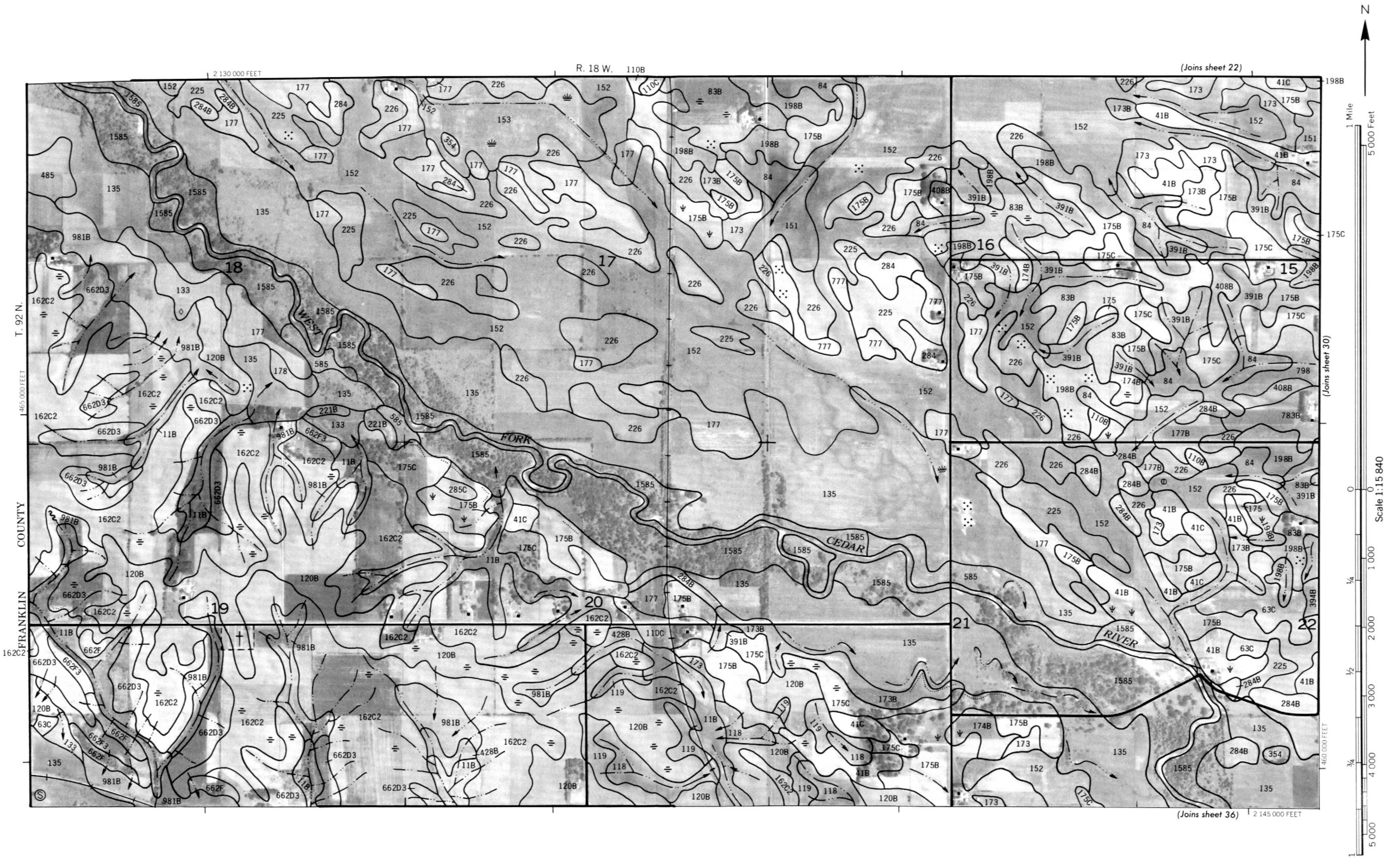

N
R. 17 W.
R. 16 W.
T. 92 N.
2 185 000 FEET
480 000 FEET
475 000 FEET
2 200 000 FEET
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
Dry
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
2
5
6
7
8
11
12

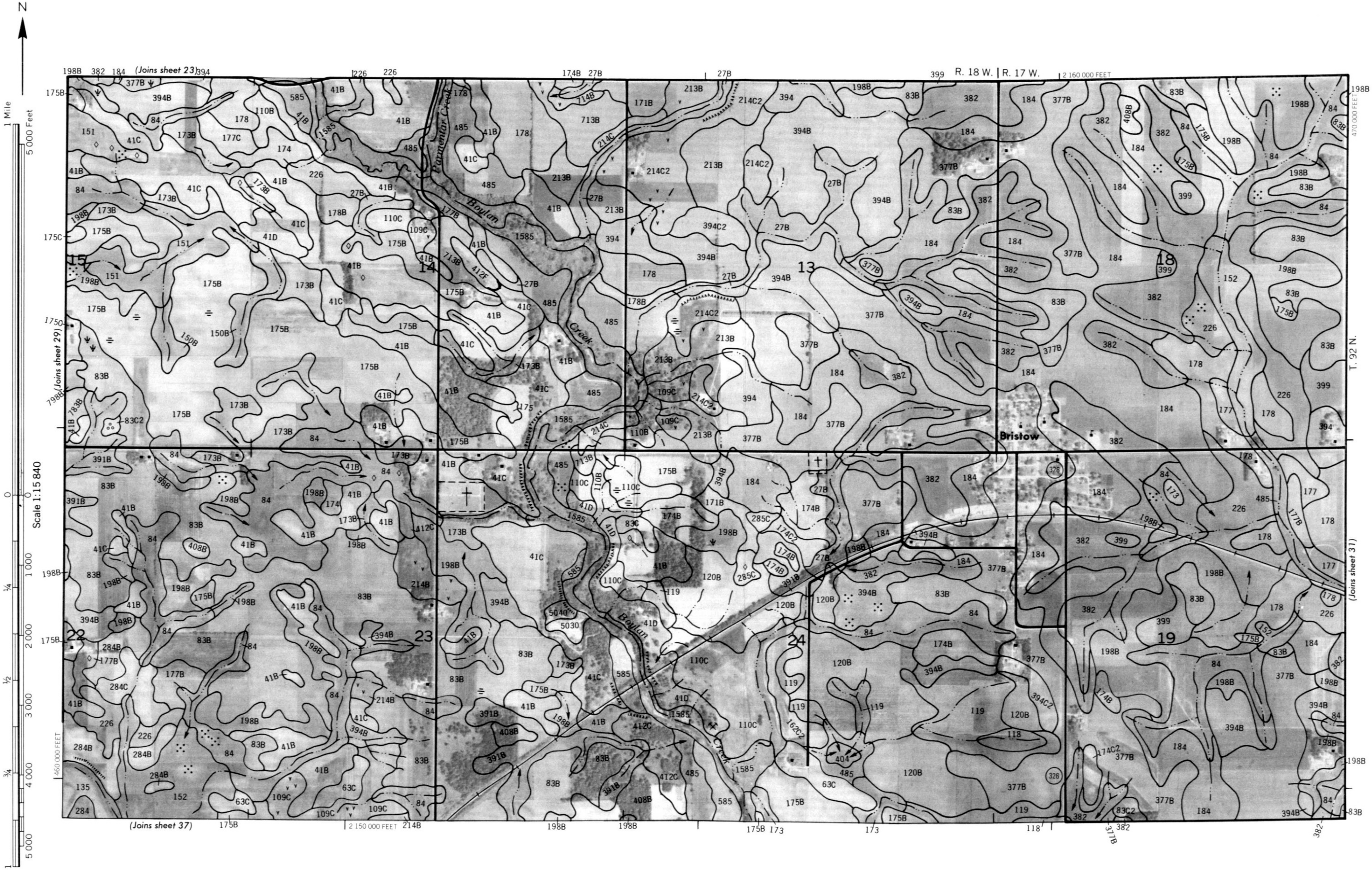
BUTLER COUNTY, IOWA — SHEET NUMBER 26

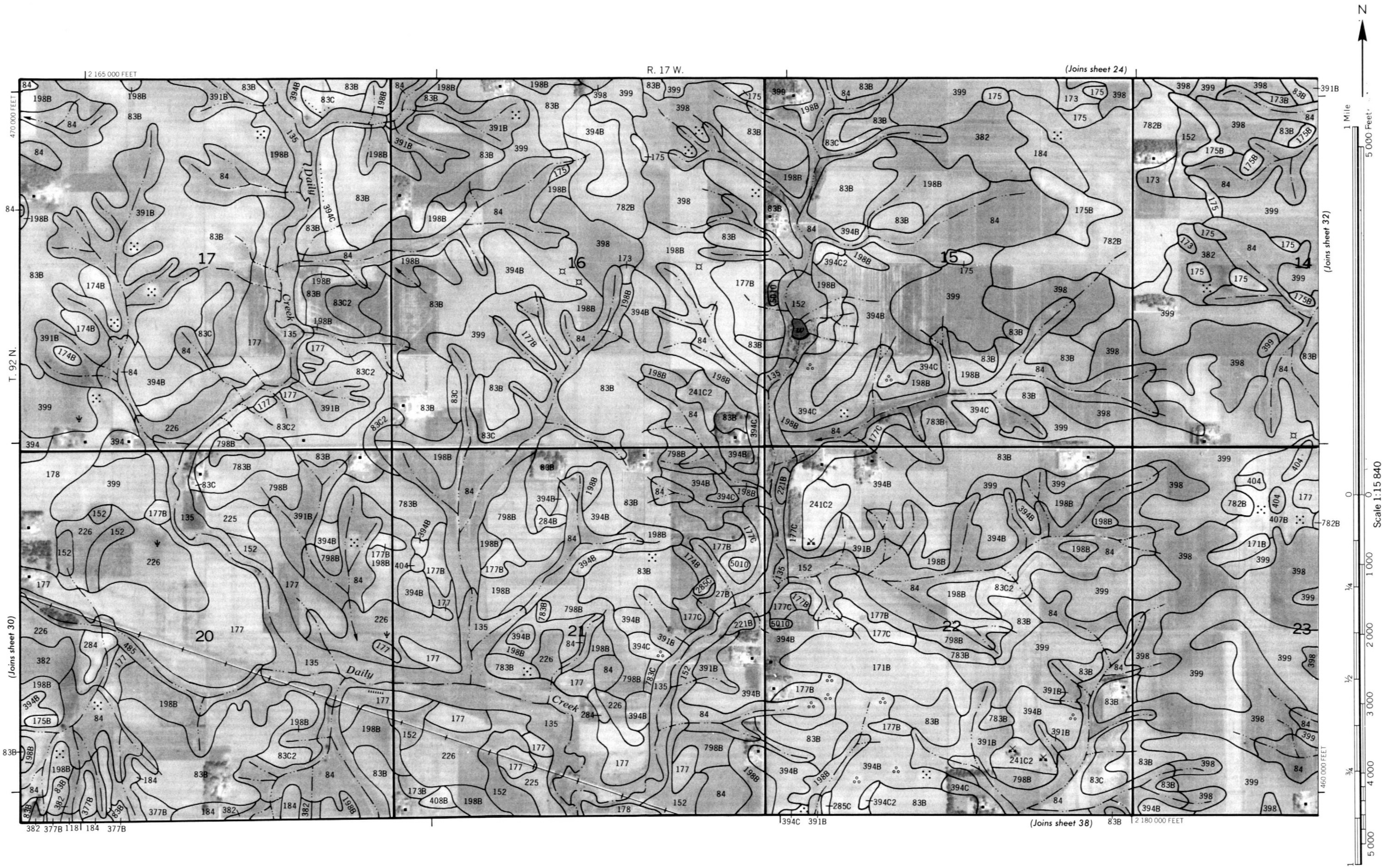



27
N
R. 16 W. | R. 15 W.
T. 92 N.
2 220 000 FEET
480 000 FEET
475 000 FEET
2 235 000 FEET
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
SHELL ROCK RIVER
Beaver Creek
CLARKSVILLE
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5000

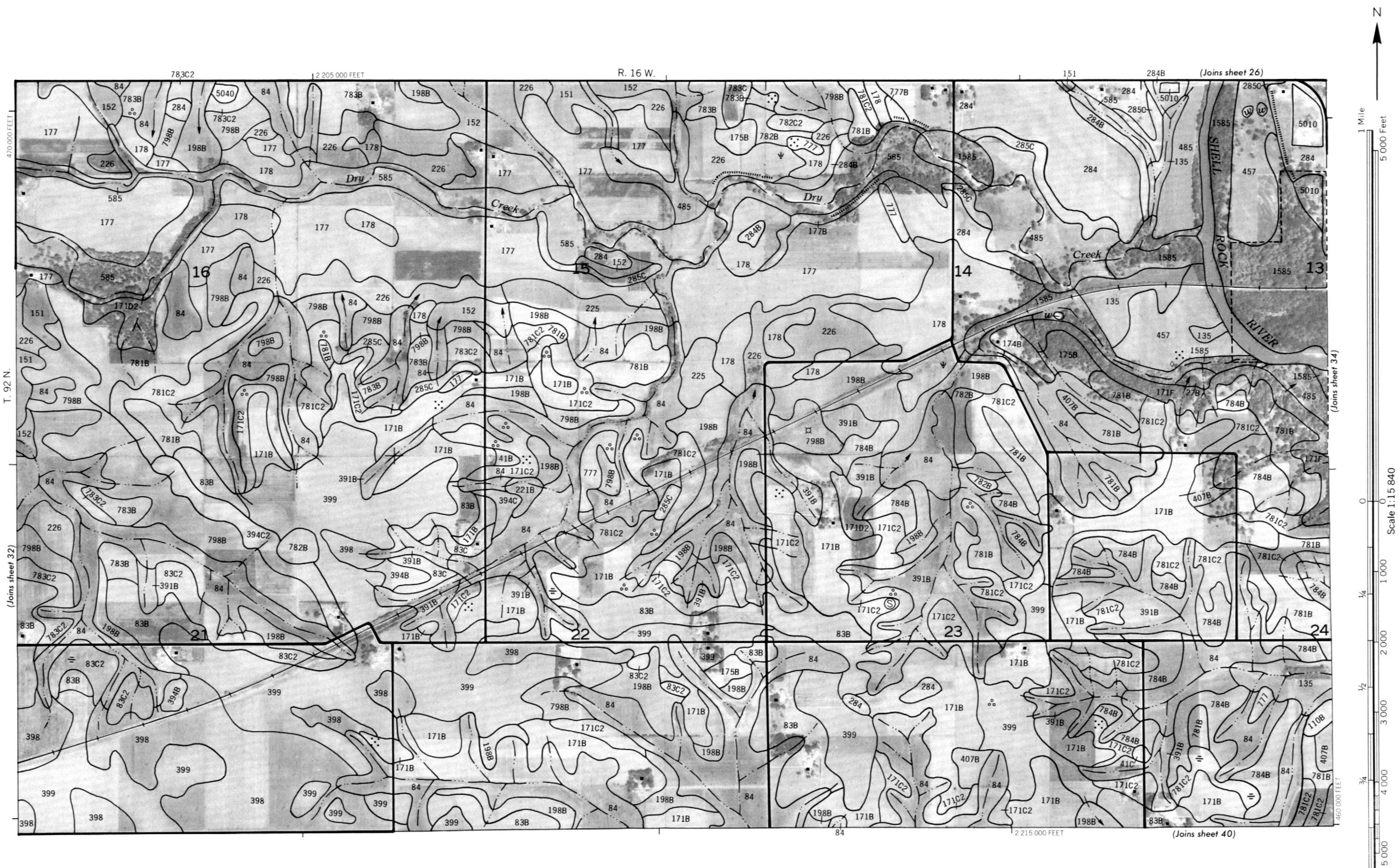

N
(Joins sheet 21)
R. 15 W.
2 225 000 FEET
480 000 FEET
(Joins sheet 27)
475 000 FEET
Beaver Creek
Curry Creek
T. 92 N.
BREMER COUNTY
2 240 000 FEET
(Joins sheet 35)
Scale 1:15 840
1 Mile
5 000 Feet


N
R. 18 W.
2 130 000 FEET
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
2 145 000 FEET
465 000 FEET
460 000 FEET
T. 92 N.
FRANKLIN COUNTY
WEST FORK
CEDAR RIVER
16
15
17
18
19
20
21
22
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

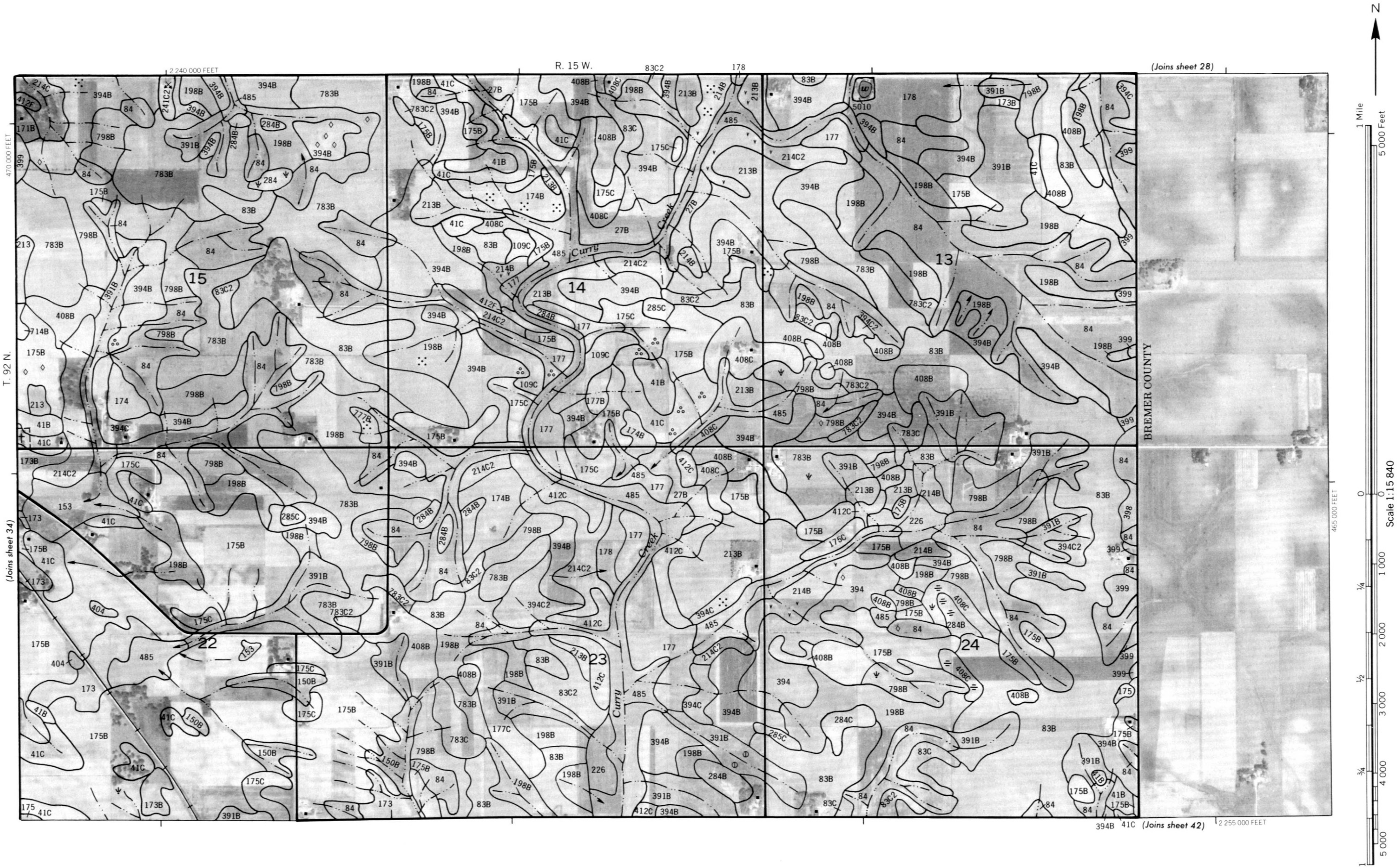

N
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
R. 18 W.
R. 17 W.
T. 92 N.
2 160 000 FEET
2 150 000 FEET
470 000 FEET
460 000 FEET
Bristow
Parmenter Creek
Boylan Creek
1 Mile
5 000 Feet
Scale 1:15 840

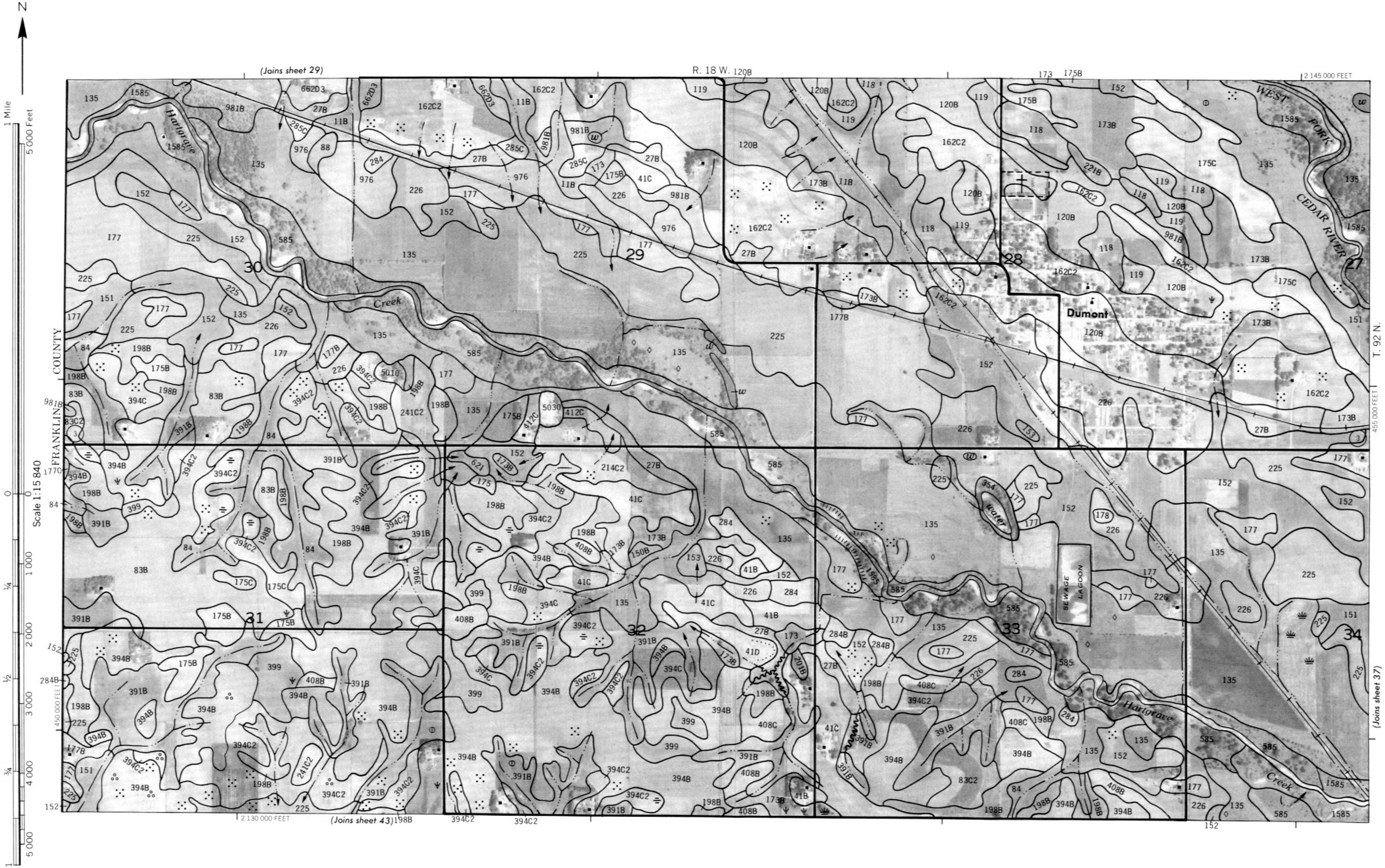

N
R. 17 W.
T. 92 N.
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 30)
2 165 000 FEET
2 180 000 FEET
470 000 FEET
460 000 FEET
17
16
15
14
20
21
22
23
Daily Creek
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

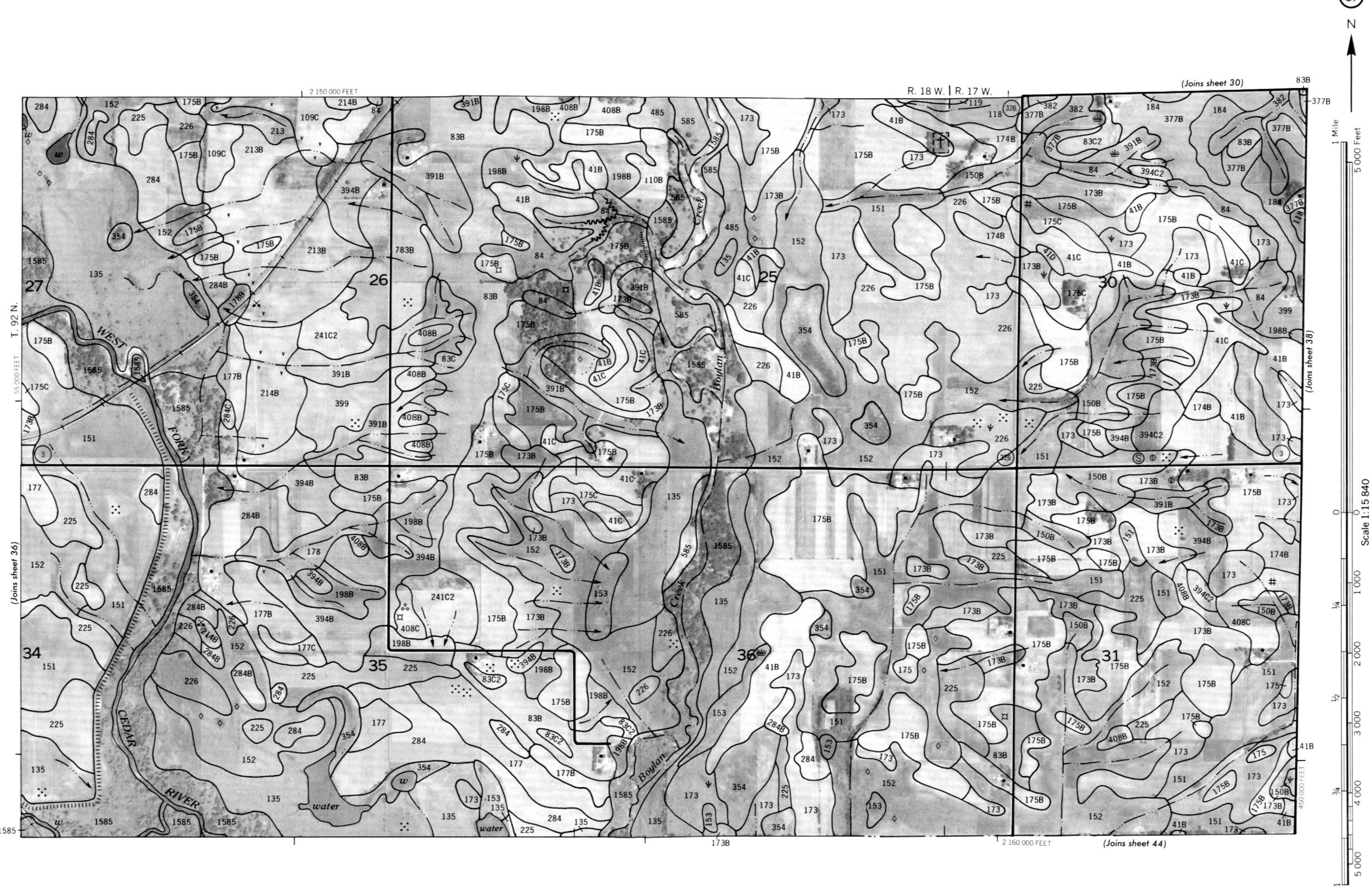

N
(Joins sheet 25)
R. 17 W.
R. 16 W.
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
T. 92 N.
2 200 000 FEET
470 000 FEET
460 000 FEET
2 185 000 FEET
Dry Creek
14
13
18
17
23
24
19
20
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

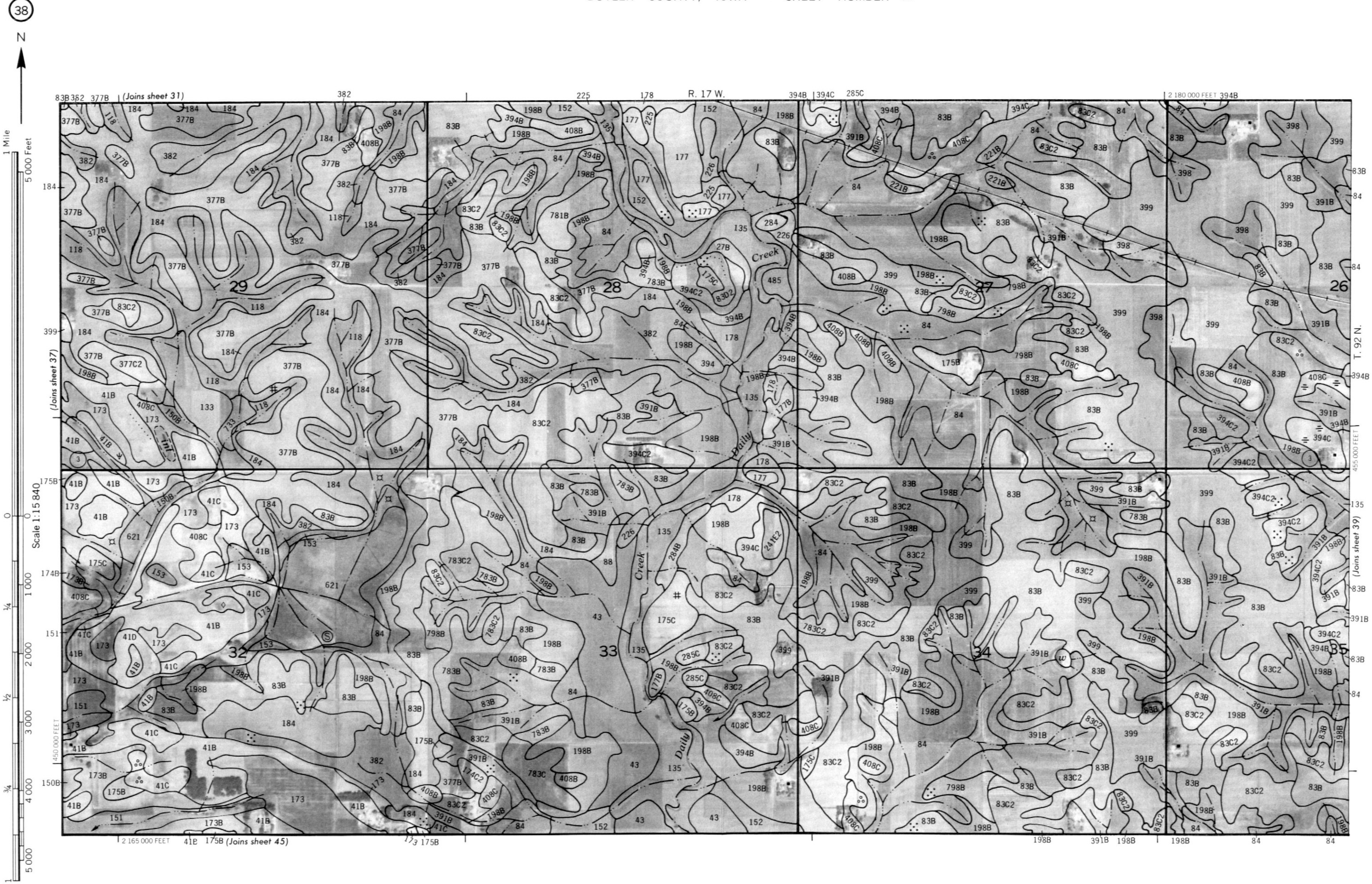

N
(Joins sheet 26)
R. 16 W.
2 205 000 FEET
470 000 FEET
T. 92 N.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
2 215 000 FEET
460 000 FEET
Dry Creek
Dry
Creek
SHELL ROCK RIVER
16
15
14
13
21
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

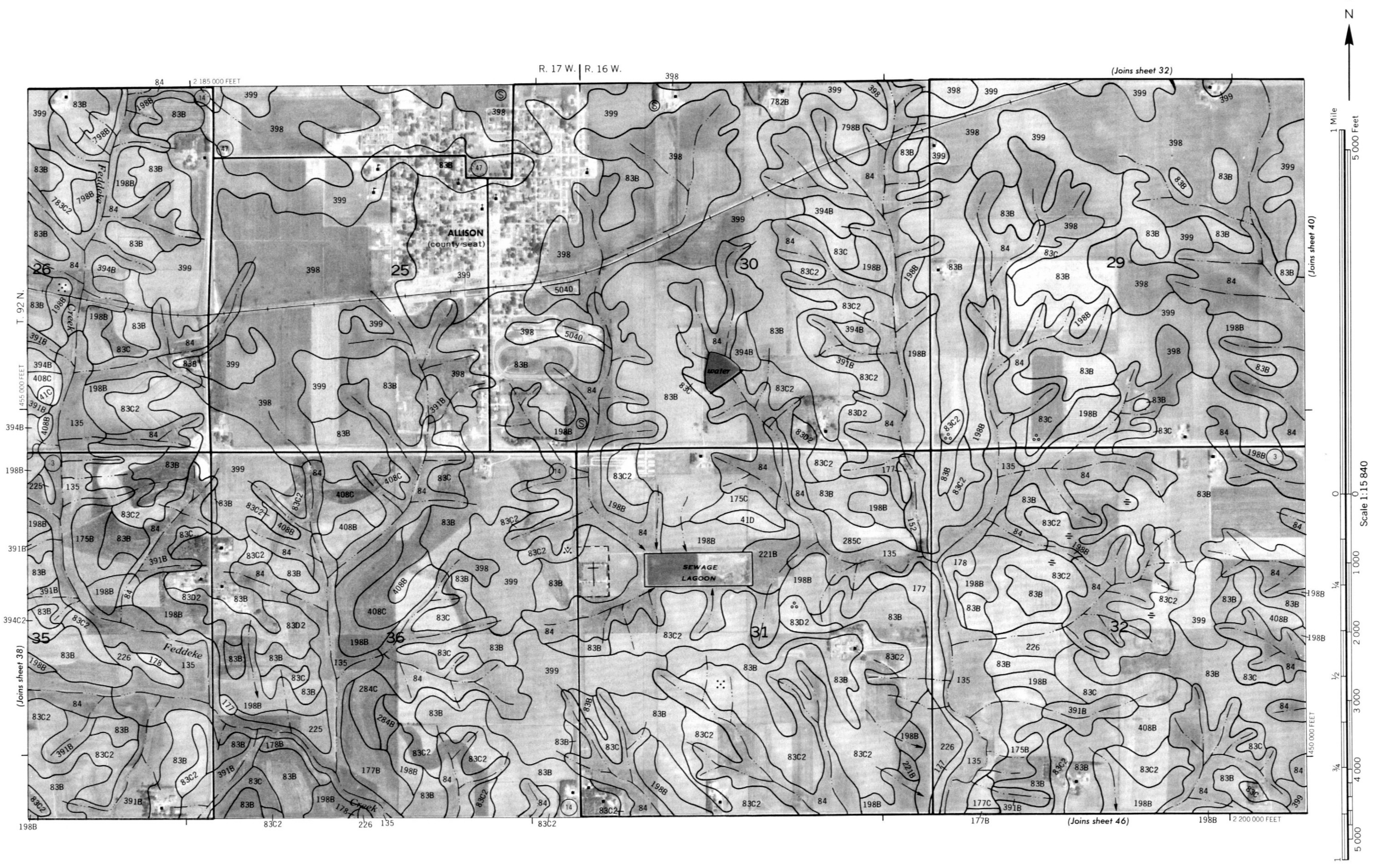

34
N
1 Mile
5 000 Feet
Scale 1:15 840
R. 16 W.
R. 15 W.
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
T. 92 N.
2 235 000 FEET
470 000 FEET
2 220 000 FEET
460 000 FEET
CLARKSVILLE
HEERY WOODS STATE PARK
SHELL ROCK RIVER
Beaver Creek
13
16
17
18
19
20
21
24
188

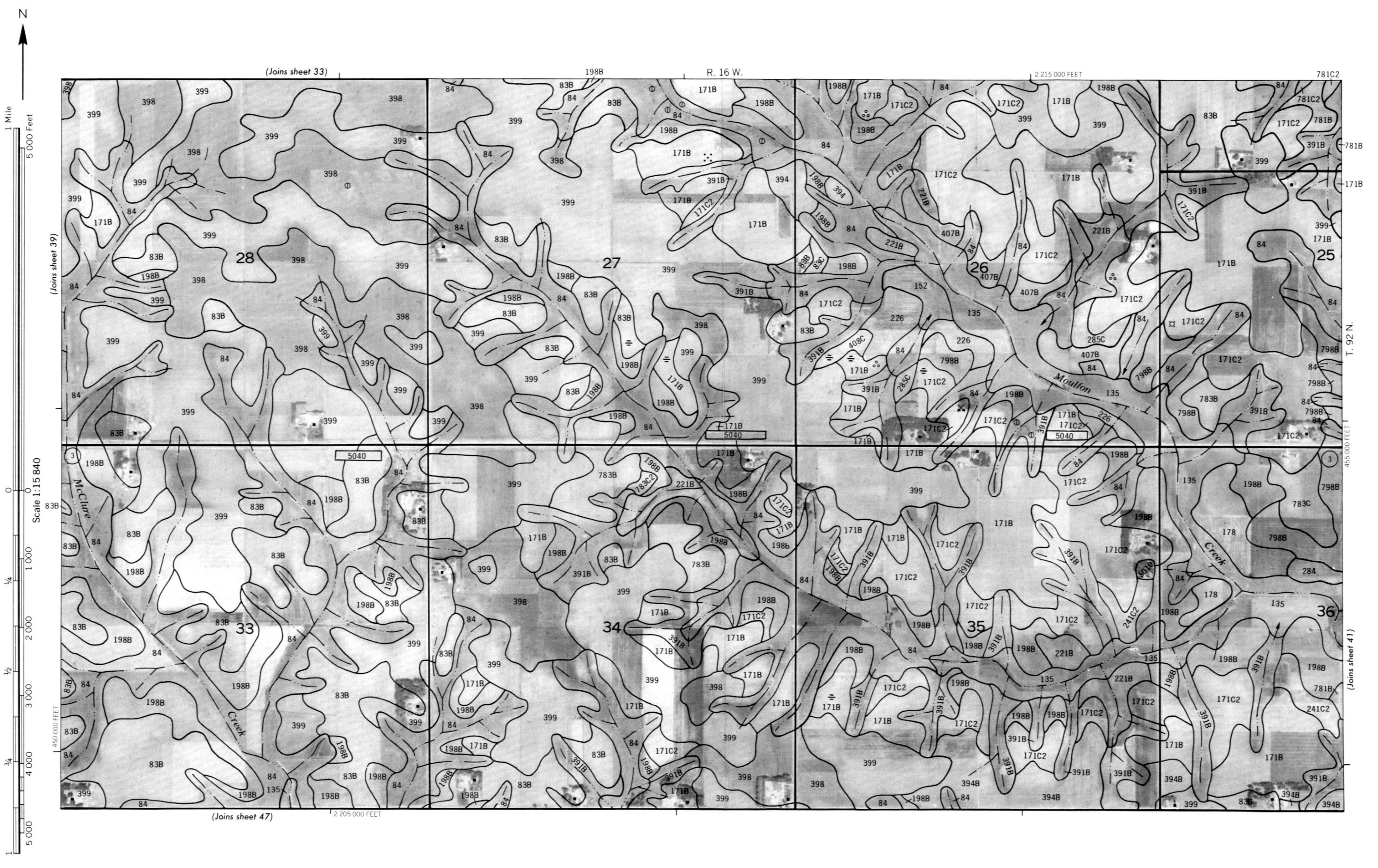

N
R. 15 W.
T. 92 N.
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 42)
BREMER COUNTY
Curry Creek
15
14
13
22
23
24
2 240 000 FEET
2 255 000 FEET
470 000 FEET
465 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

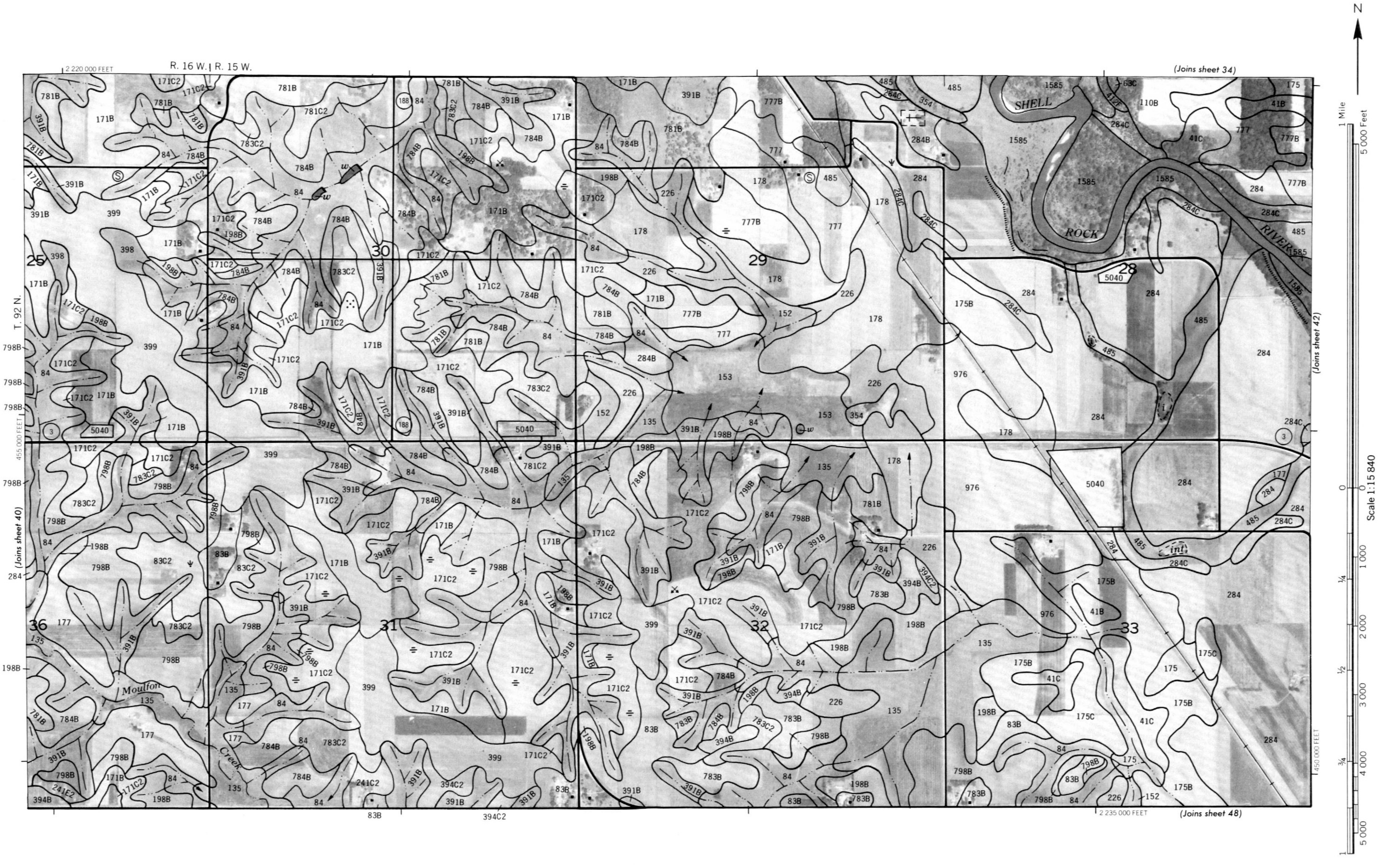

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 29)
R. 18 W.
2 145 000 FEET
T. 92 N.
455 000 FEET
450 000 FEET
2 130 000 FEET
(Joins sheet 43)
(Joins sheet 37)
FRANKLIN COUNTY
Hartgrave Creek
WEST FORK CEDAR RIVER
Dumont
SEWAGE LAGOON
water
30
29
28
27
31
32
33
34

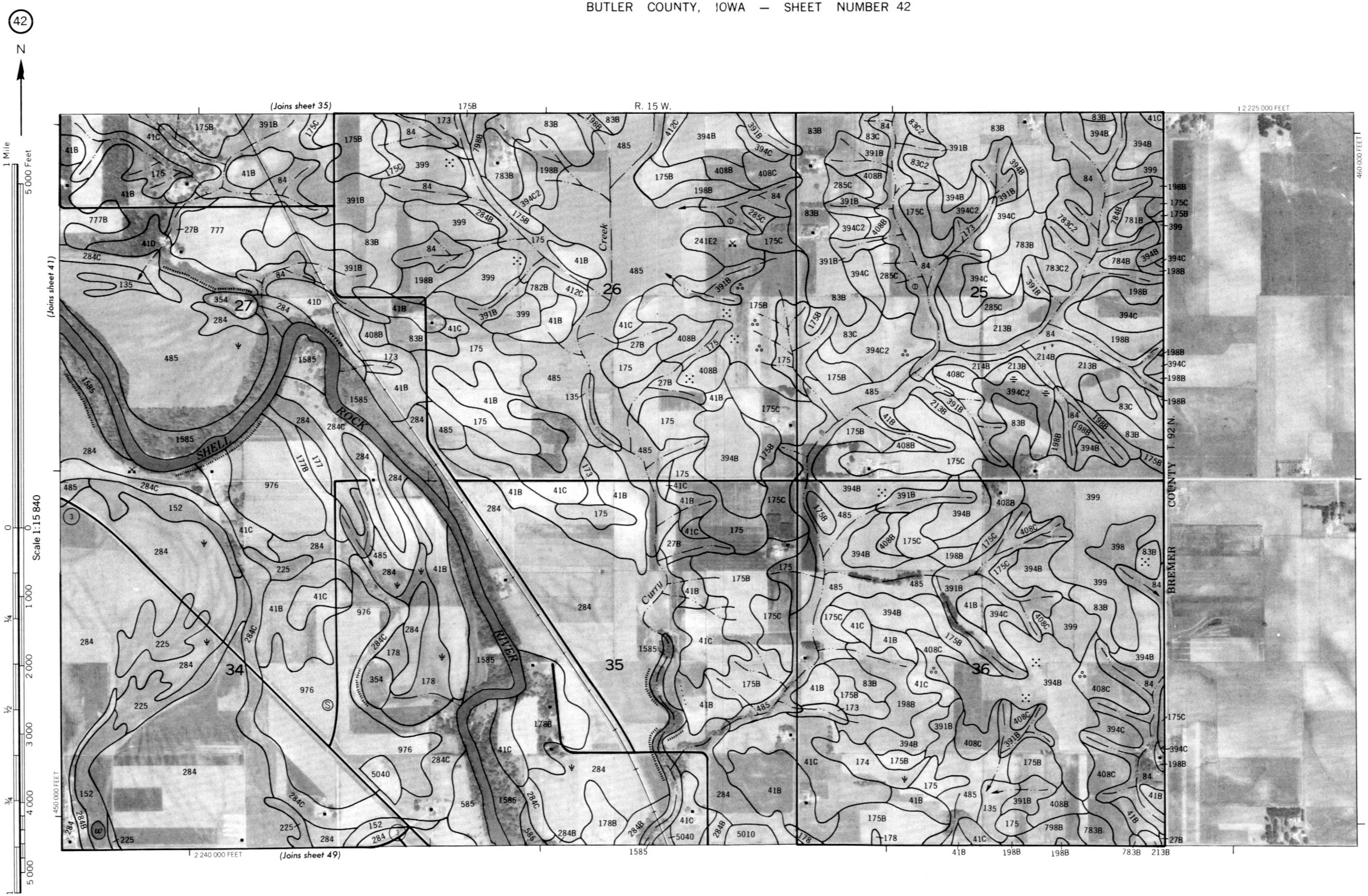

37
N
(Joins sheet 30)
R. 18 W. | R. 17 W.
2 150 000 FEET
T. 92 N.
55 000 FEET
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 44)
2 160 000 FEET
450 000 FEET
WEST FORK
CEDAR RIVER
Boylan Creek
water
1 Mile
5 000 Feet
Scale 1:15 840

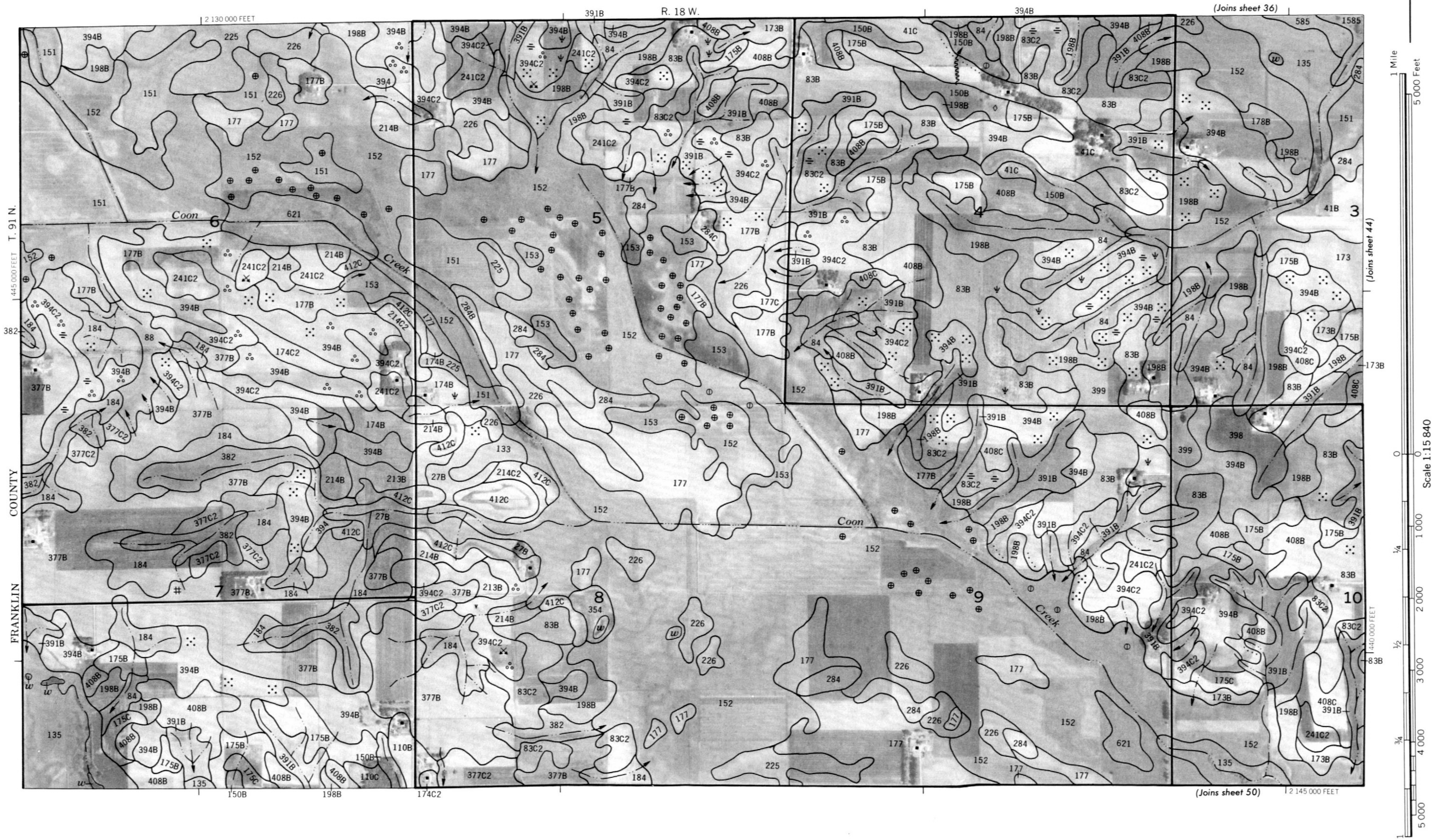

38
N
(Joins sheet 31)
R. 17 W.
T. 92 N.
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
2 180 000 FEET
2 165 000 FEET
455 000 FEET
450 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
Daily Creek
29
28
27
26
32
33
34
35


N
R. 17 W.
R. 16 W.
T. 92 N.
2 185 000 FEET
2 200 000 FEET
455 000 FEET
450 000 FEET
(Joins sheet 32)
(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 38)
ALLISON
(county seat)
SEWAGE
LAGOON
water
Feddeke
Creek
26
25
30
29
35
36
31
32
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

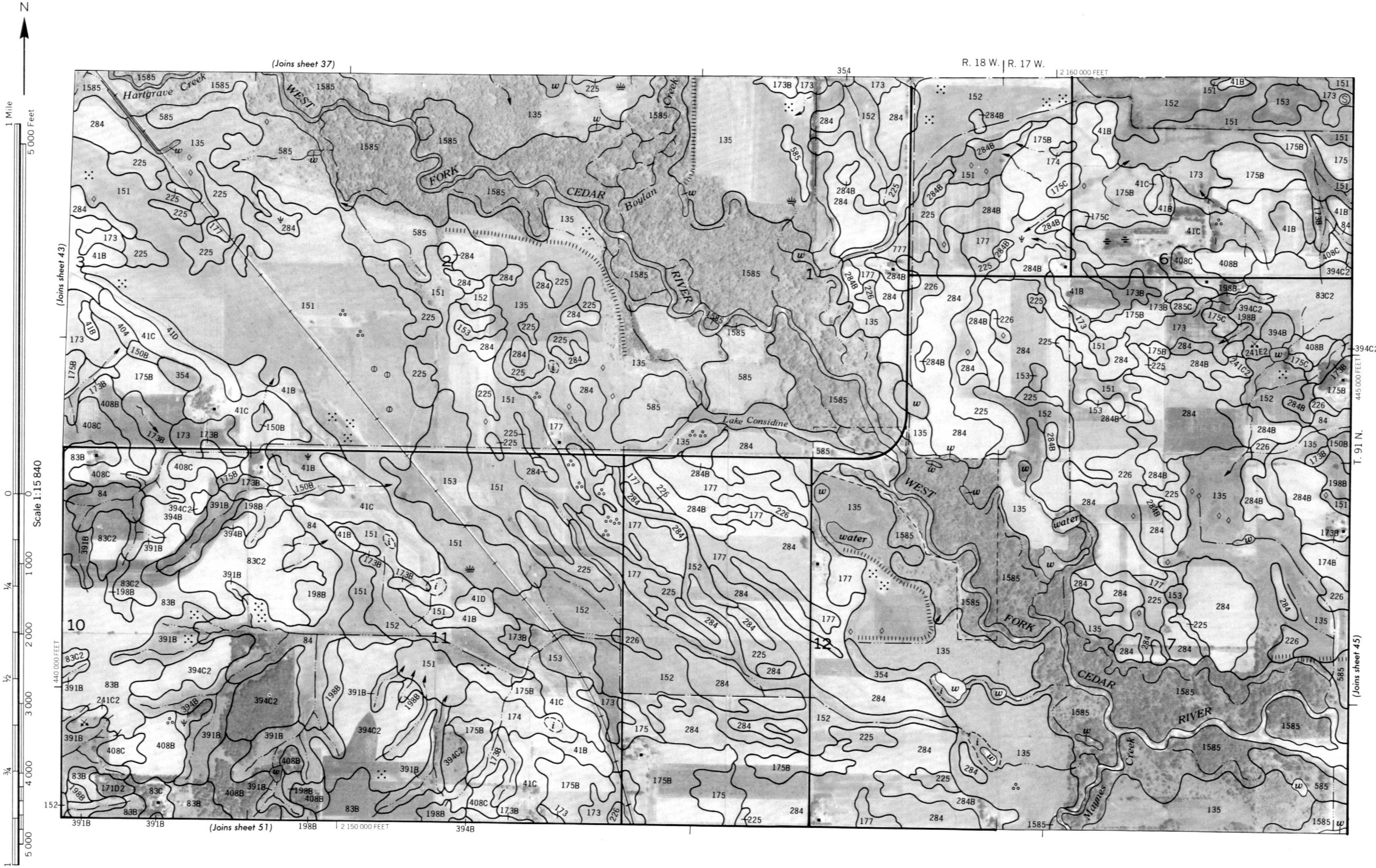

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 33)
R. 16 W.
2 215 000 FEET
(Joins sheet 39)
T. 92 N.
(Joins sheet 41)
(Joins sheet 47)
2 205 000 FEET
455 000 FEET
450 000 FEET
28
27
26
25
33
34
35
36
McClure Creek
Moulton
Creek

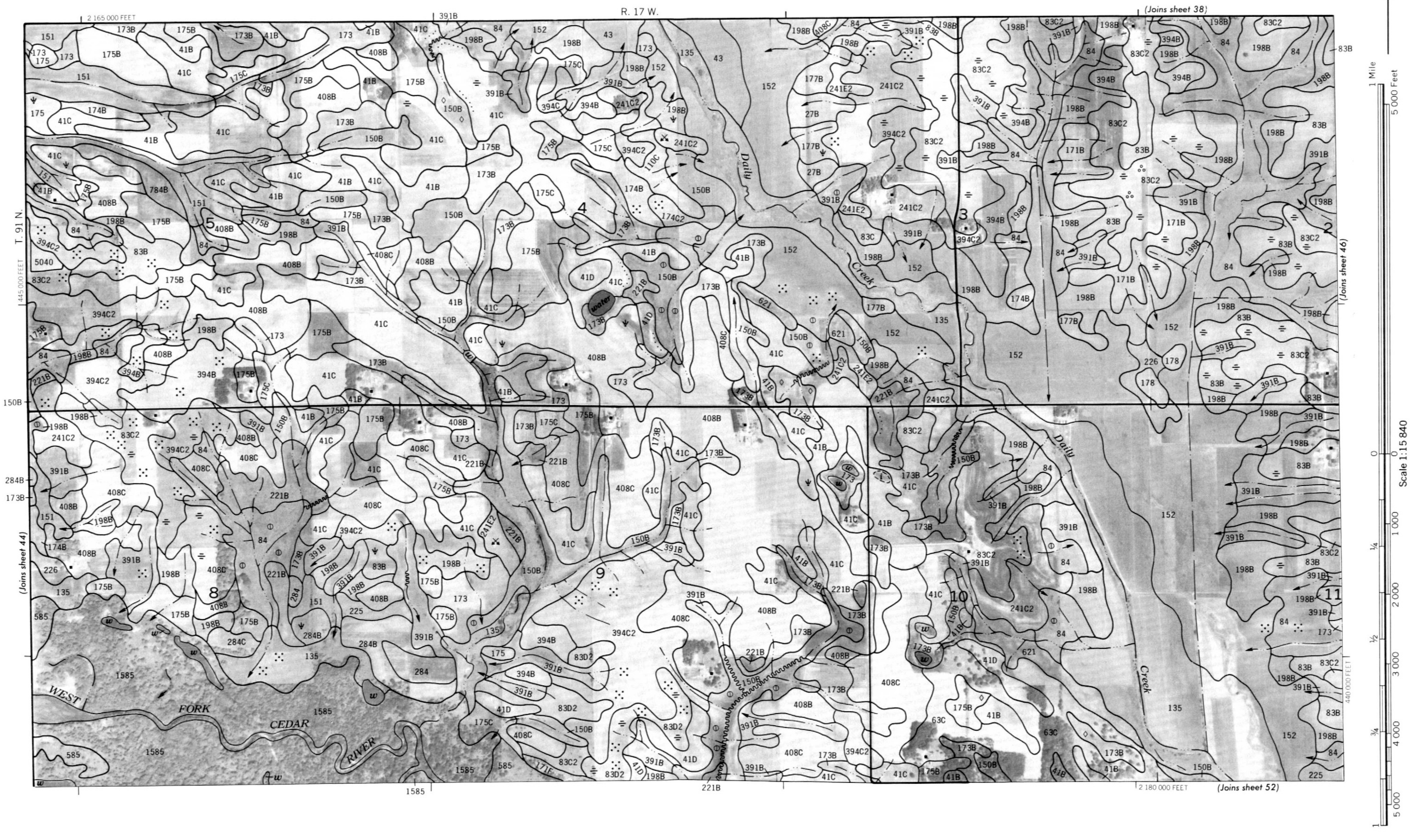

N
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
R. 16 W. | R. 15 W.
T. 92 N.
2 220 000 FEET
455 000 FEET
450 000 FEET
2 235 000 FEET
25
30
29
28
36
31
32
33
SHELL ROCK RIVER
Moulton Creek
1 Mile
5 000 Feet
Scale 1:15 840

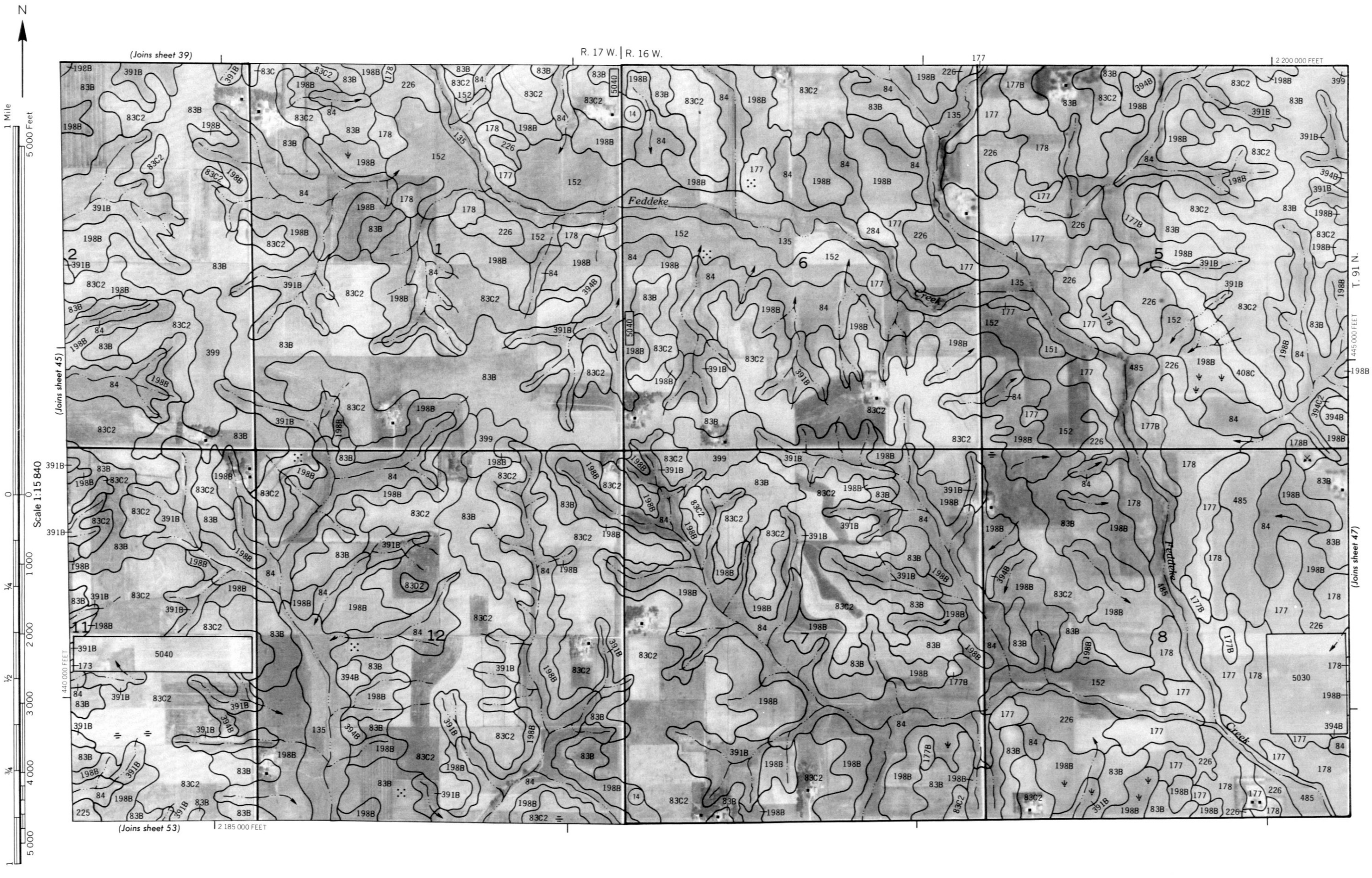

42
N
(Joins sheet 35)
R. 15 W.
(Joins sheet 41)
(Joins sheet 49)
SHELL
ROCK
RIVER
Creek
Curry
27
26
25
34
35
36
BREMER COUNTY
T. 92 N.
2 225 000 FEET
460 000 FEET
450 000 FEET
2 240 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

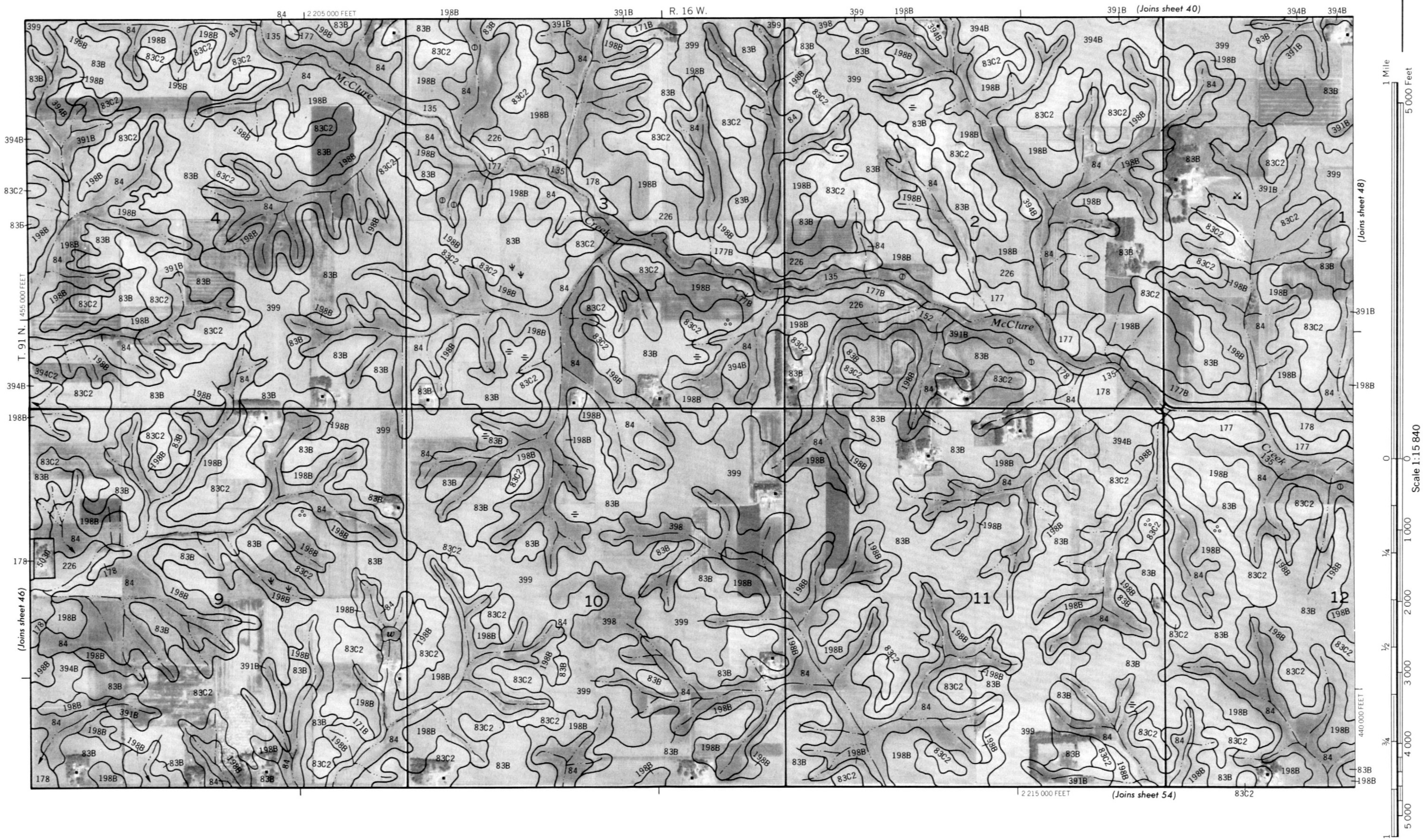

N
R. 18 W.
T. 91 N.
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 50)
2 130 000 FEET
2 145 000 FEET
445 000 FEET
440 000 FEET
FRANKLIN COUNTY
Coon Creek
Scale 1:15 840
1 Mile
5 000 Feet

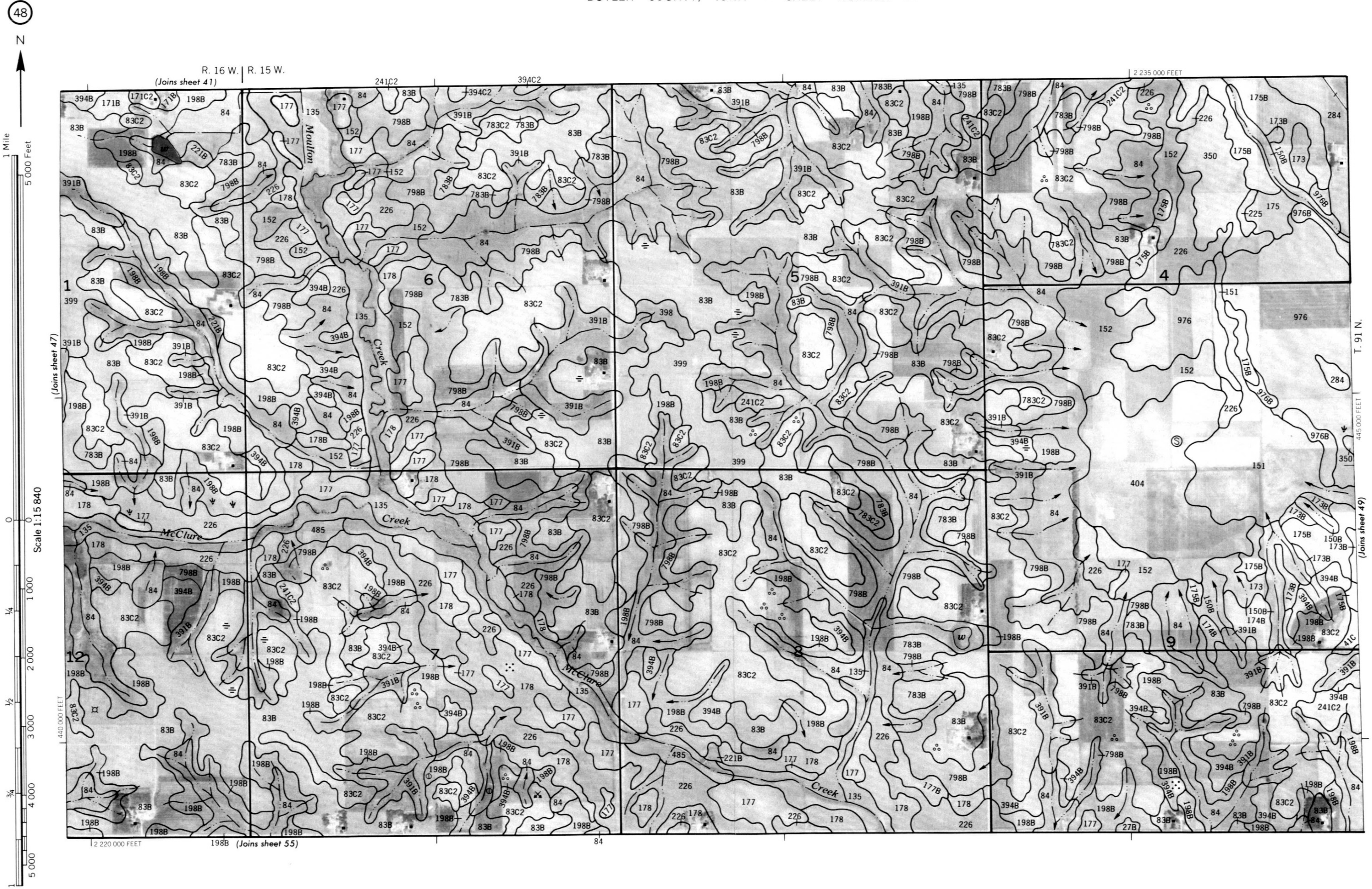
BUTLER COUNTY, IOWA — SHEET NUMBER 44

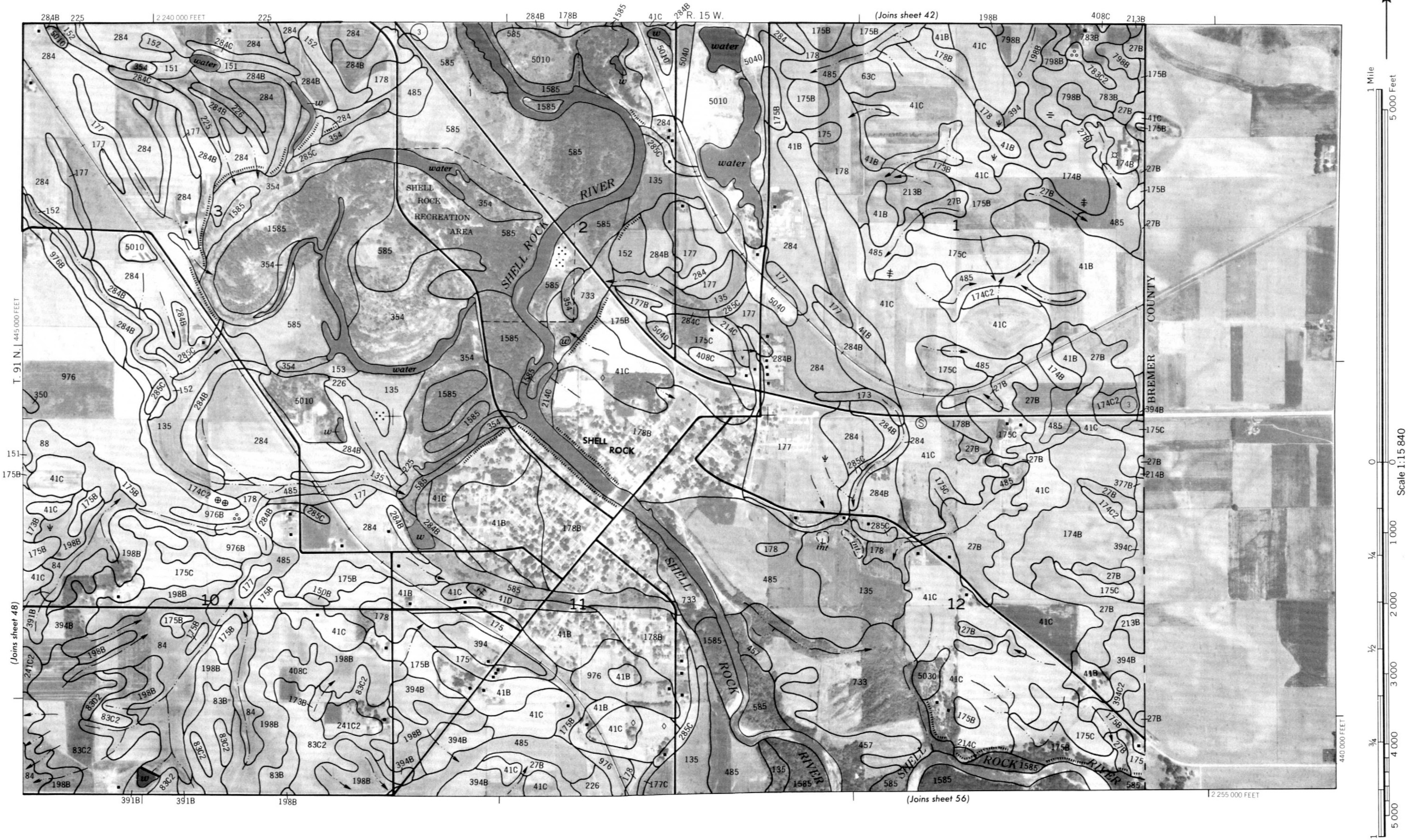


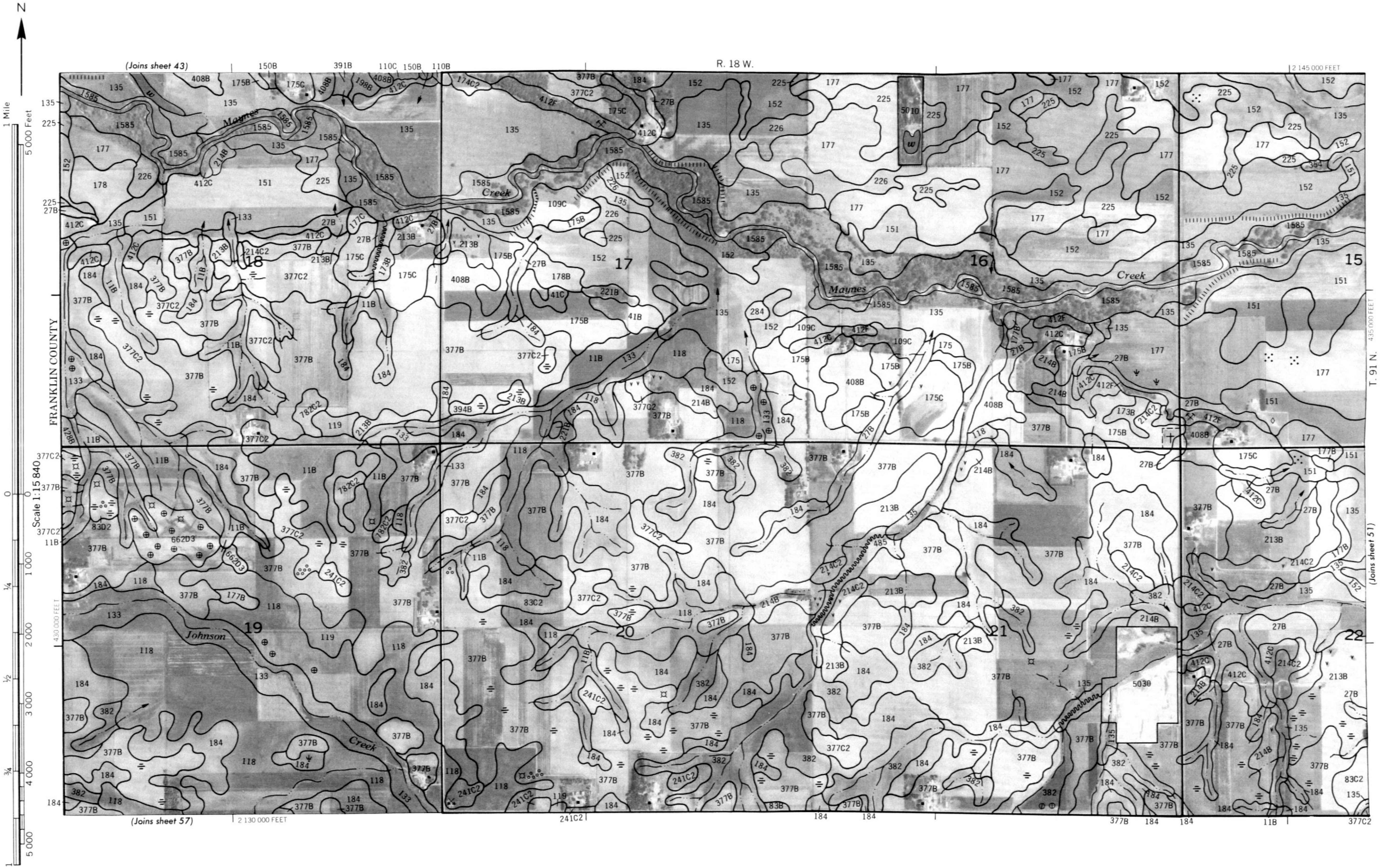

45
N
R. 17 W.
T. 91 N.
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 44)
(Joins sheet 52)
2 165 000 FEET
2 180 000 FEET
445 000 FEET
440 000 FEET
Daily Creek
Daily Creek
WEST FORK CEDAR RIVER
water
Scale 1:15 840
1 Mile
5 000 Feet

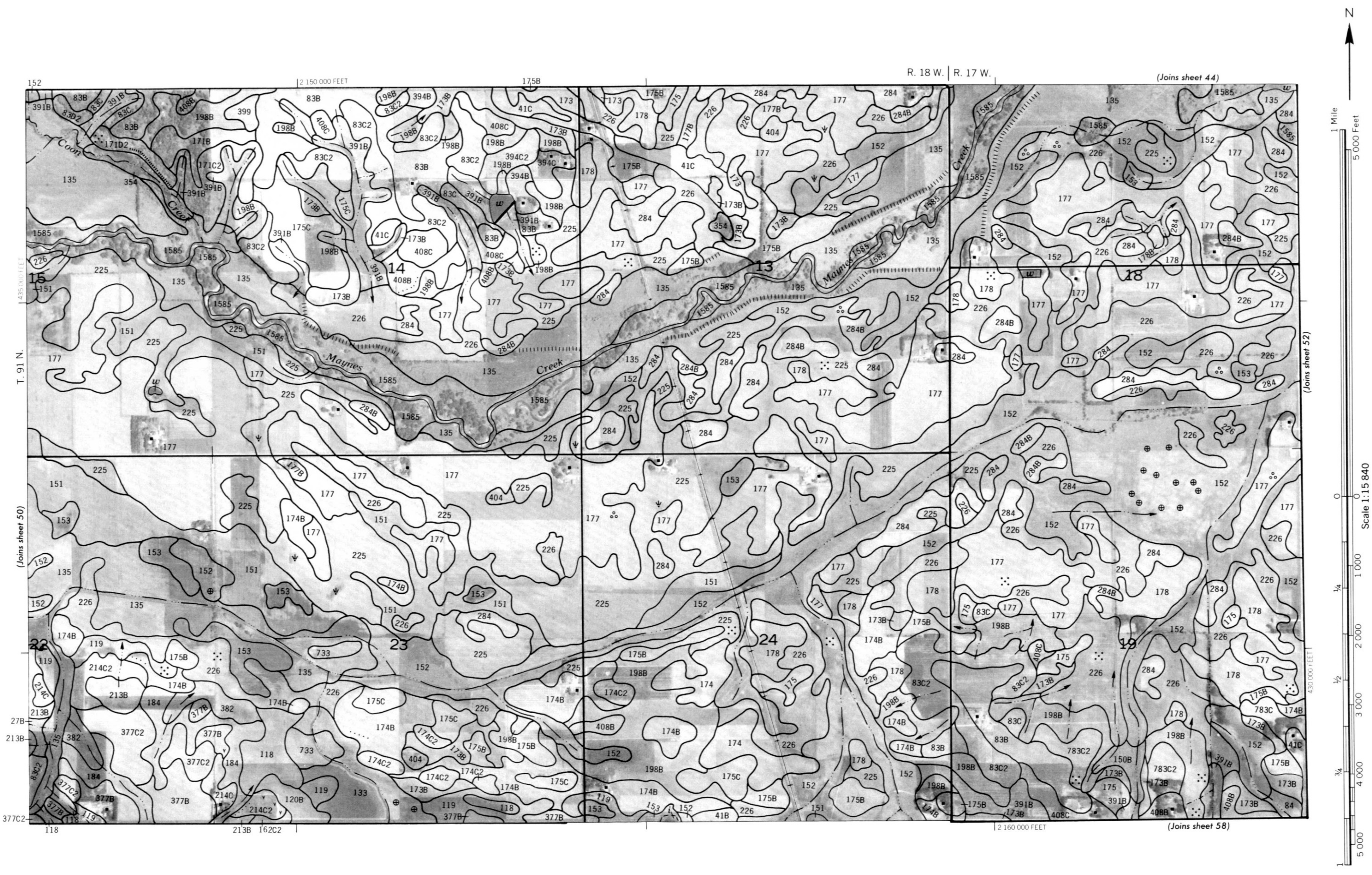

N
(Joins sheet 39)
R. 17 W. | R. 16 W.
2 200 000 FEET
T. 91 N.
445 000 FEET
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
2 185 000 FEET
440 000 FEET
Feddeke Creek
Feddeke Creek
1
2
5
6
7
8
11
12
5040
5030
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
0
¼
½
¾


N
R. 16 W.
T. 91 N.
(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 54)
(Joins sheet 46)
McClure Creek
2 205 000 FEET
2 215 000 FEET
455 000 FEET
440 000 FEET
1
2
3
4
9
10
11
12
Scale 1:15 840
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

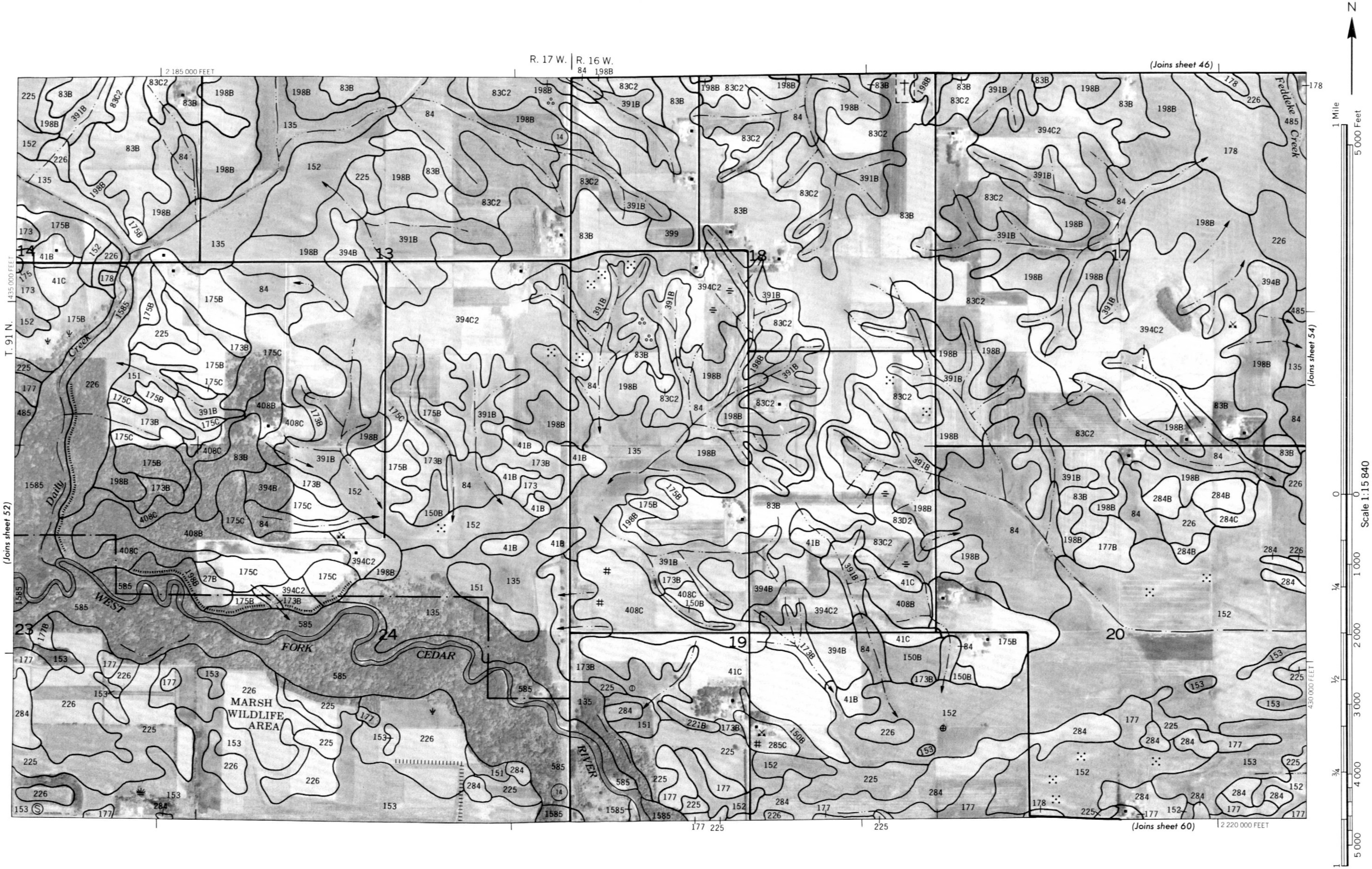

48
N
1 Mile
5 000 Feet
Scale 1:15 840
R. 16 W.
R. 15 W.
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 55)
T. 91 N.
2 235 000 FEET
2 220 000 FEET
445 000 FEET
440 000 FEET
Moulton Creek
McClure Creek
McClure
Creek

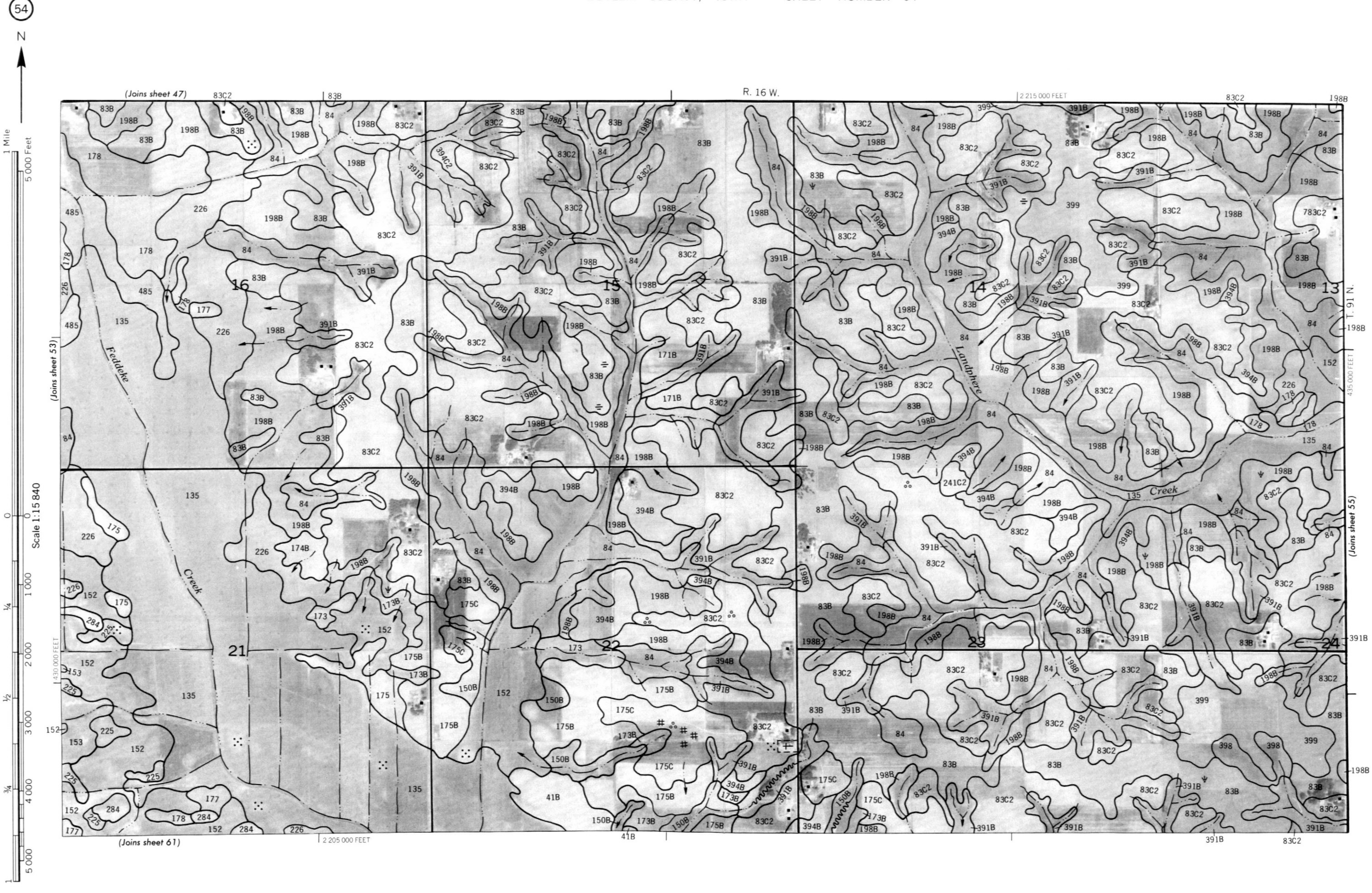

N
(Joins sheet 42)
R. 15 W.
2 240 000 FEET
T. 91 N.
445 000 FEET
(Joins sheet 48)
SHELL ROCK RECREATION AREA
SHELL ROCK RIVER
SHELL ROCK
BREMER COUNTY
(Joins sheet 56)
2 255 000 FEET
440 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

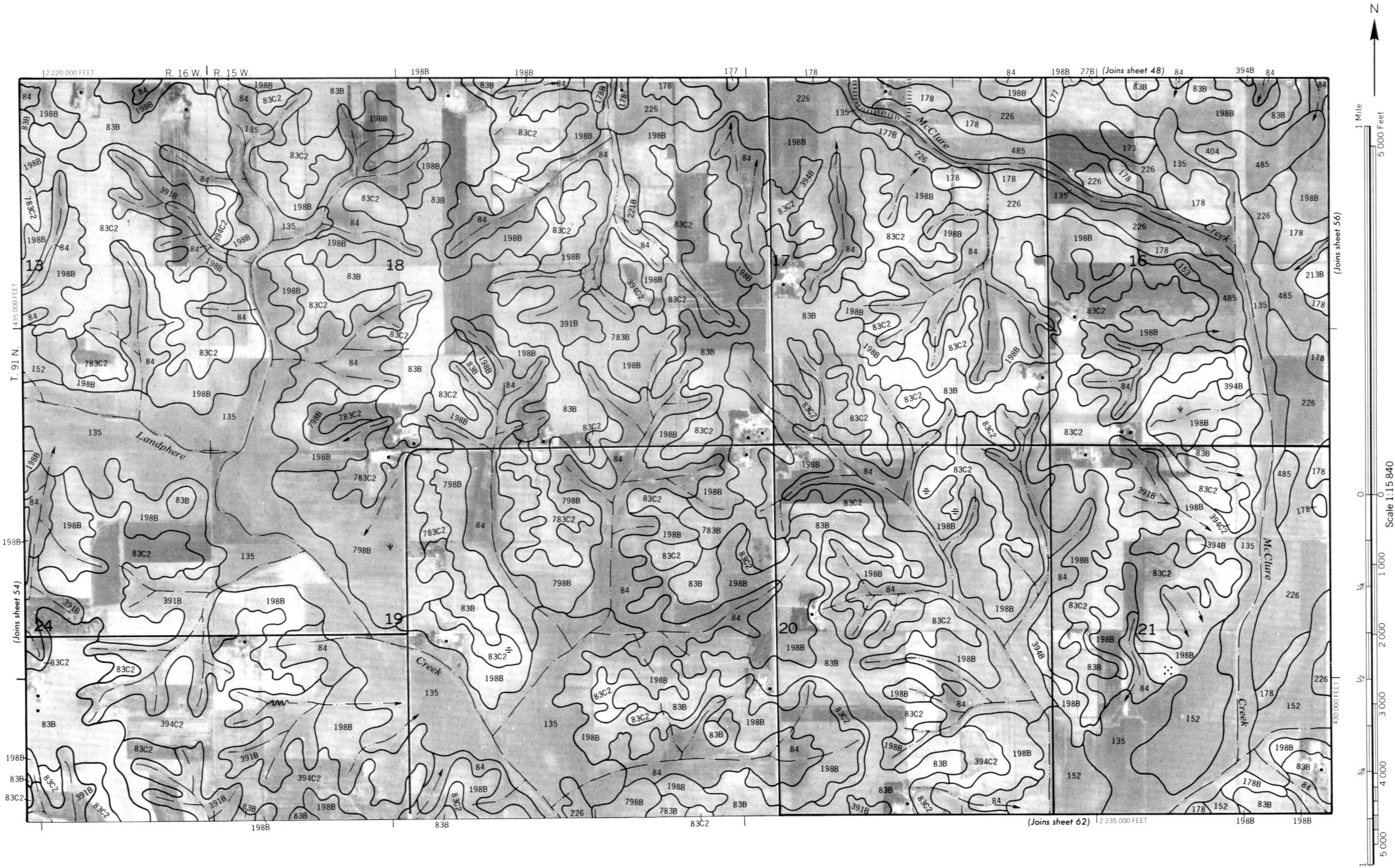

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 43)
R. 18 W.
2 145 000 FEET
435 000 FEET
T. 91 N.
(Joins sheet 51)
(Joins sheet 57)
2 130 000 FEET
430 000 FEET
FRANKLIN COUNTY
Maynes Creek
Johnson Creek
18
17
16
15
19
20
21
22

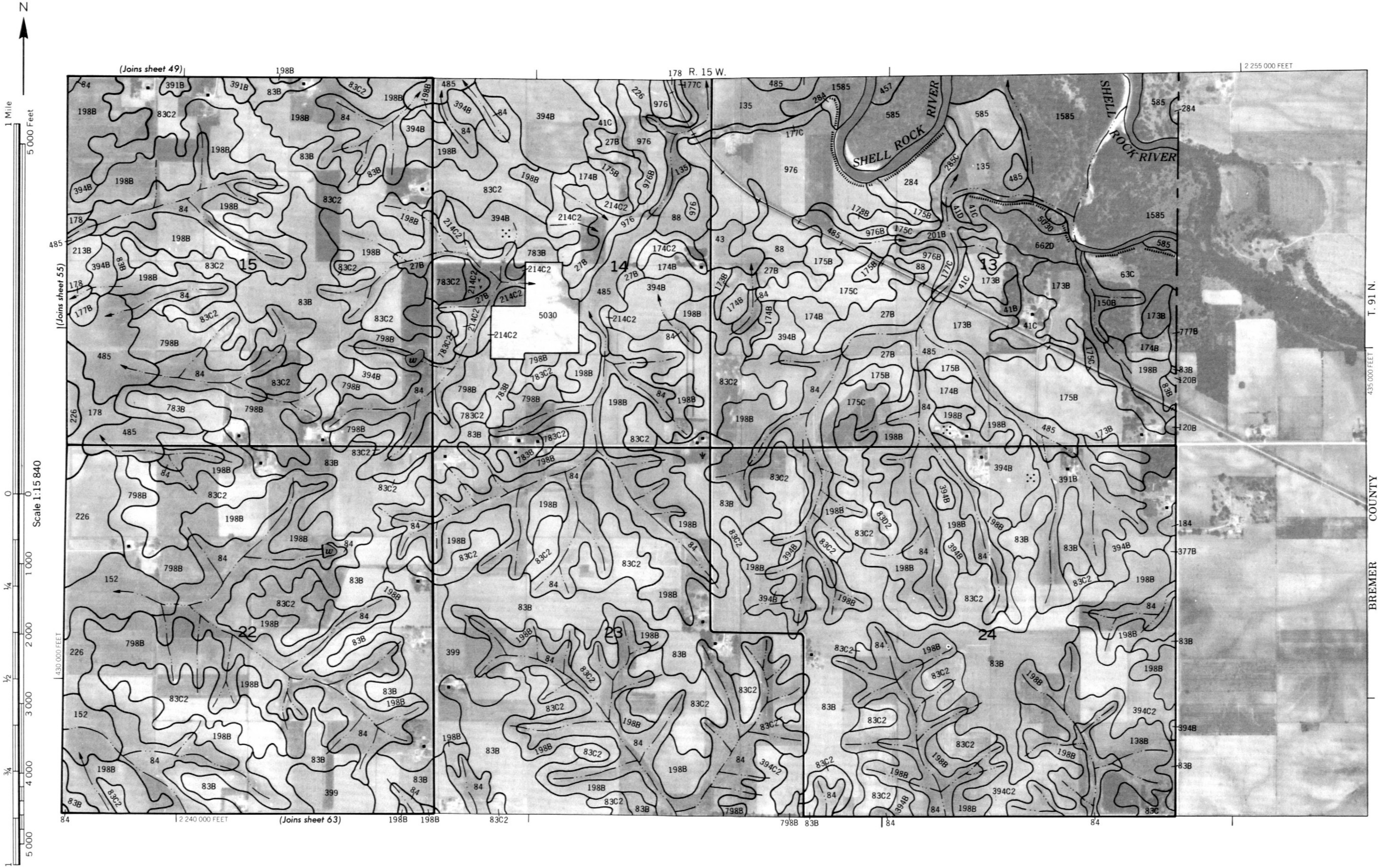

N
R. 18 W.
R. 17 W.
(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 50)
T. 91 N.
Coon Creek
Maynes Creek
2 150 000 FEET
2 160 000 FEET
435 000 FEET
430 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

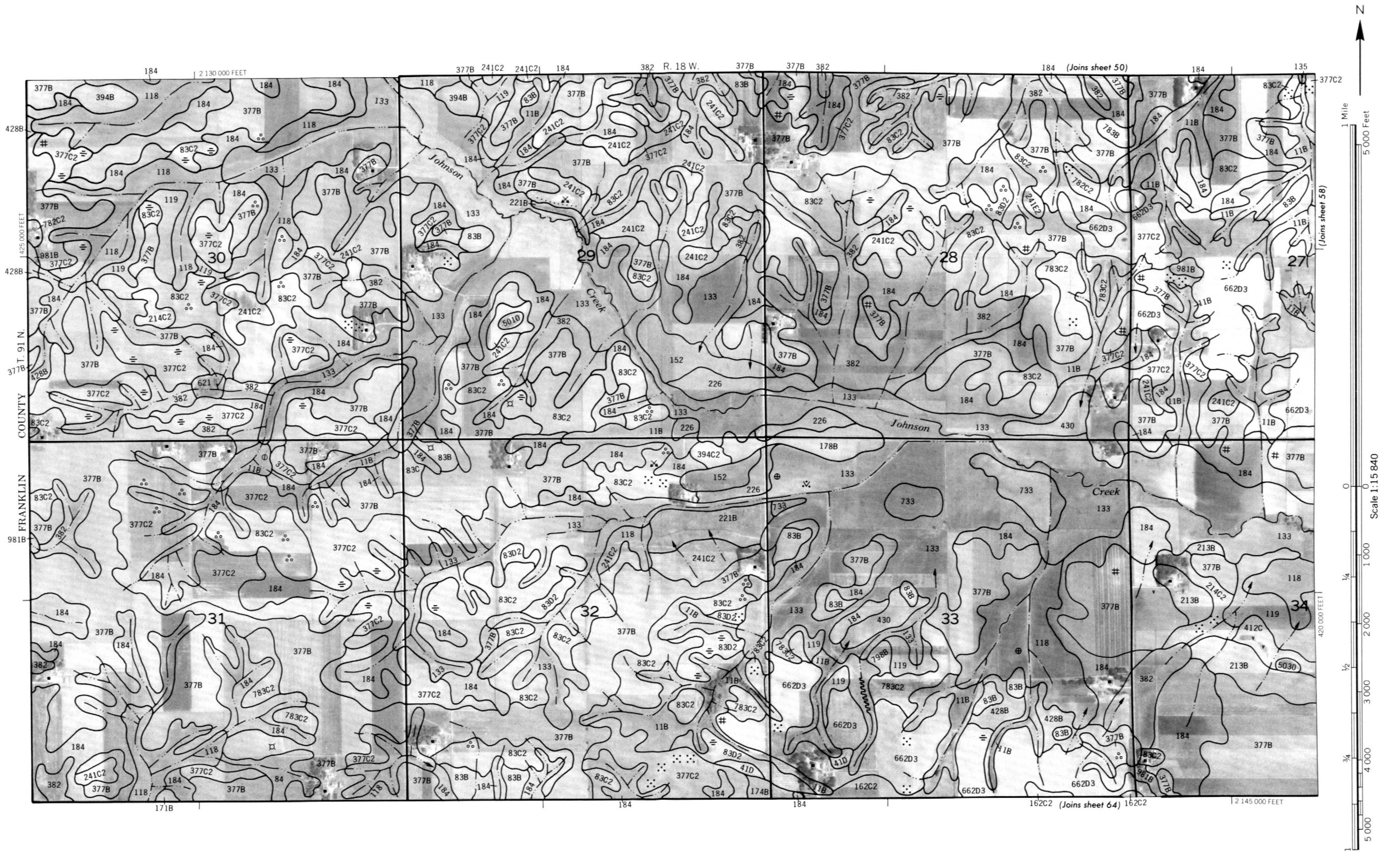

N
(Joins sheet 45)
R. 17 W.
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 59)
T. 91 N.
WEST FORK
CEDAR RIVER
Daily Creek
2 180 000 FEET
435 000 FEET
430 000 FEET
2 165 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
17
16
15
14
20
21
22
23

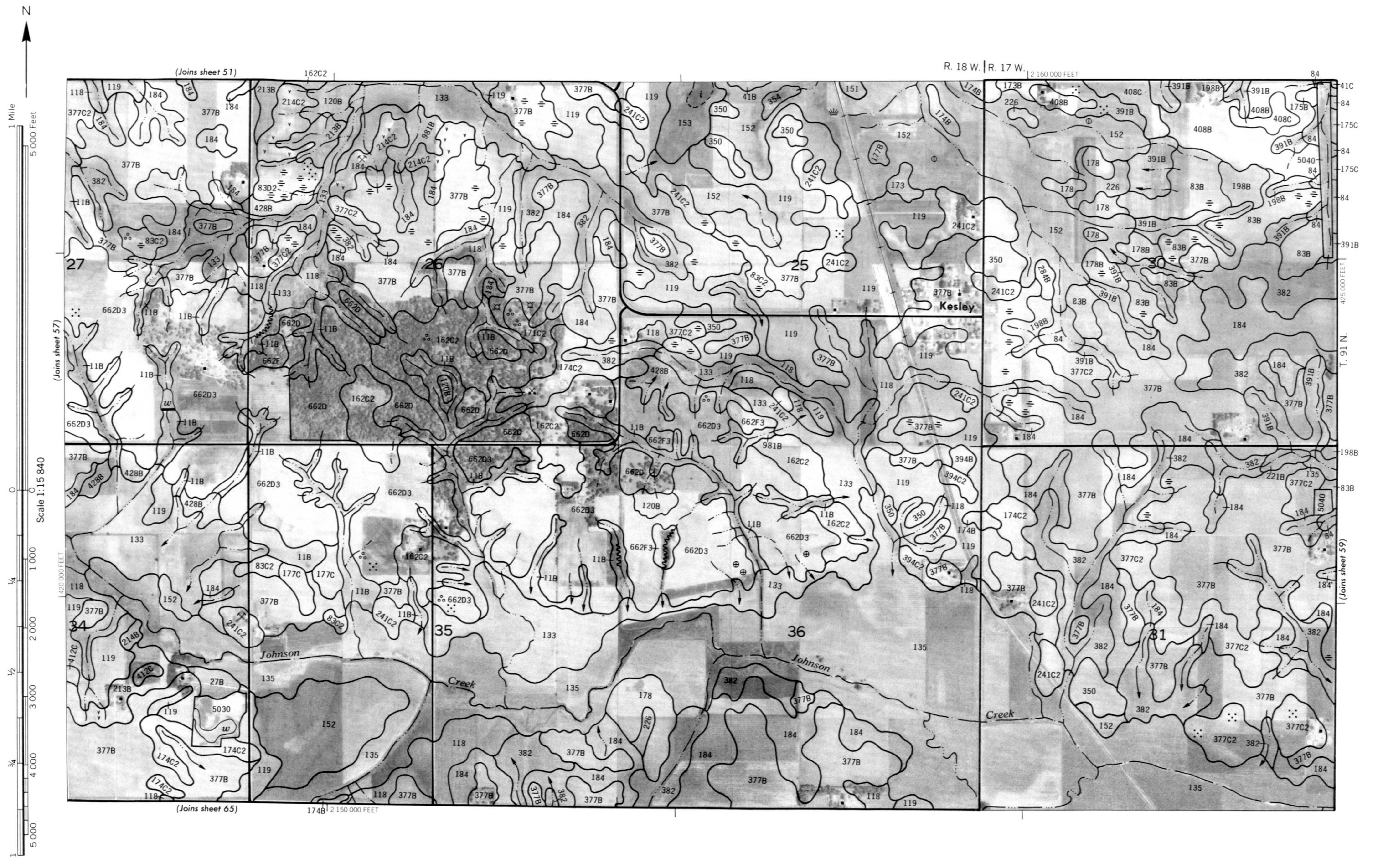

N
R. 17 W.
R. 16 W.
2 185 000 FEET
(Joins sheet 46)
(Joins sheet 54)
(Joins sheet 60)
(Joins sheet 52)
T. 91 N.
435 000 FEET
430 000 FEET
2 220 000 FEET
Feldeke Creek
Daily Creek
WEST FORK CEDAR RIVER
MARSH WILDLIFE AREA
14
13
18
17
23
24
19
20
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

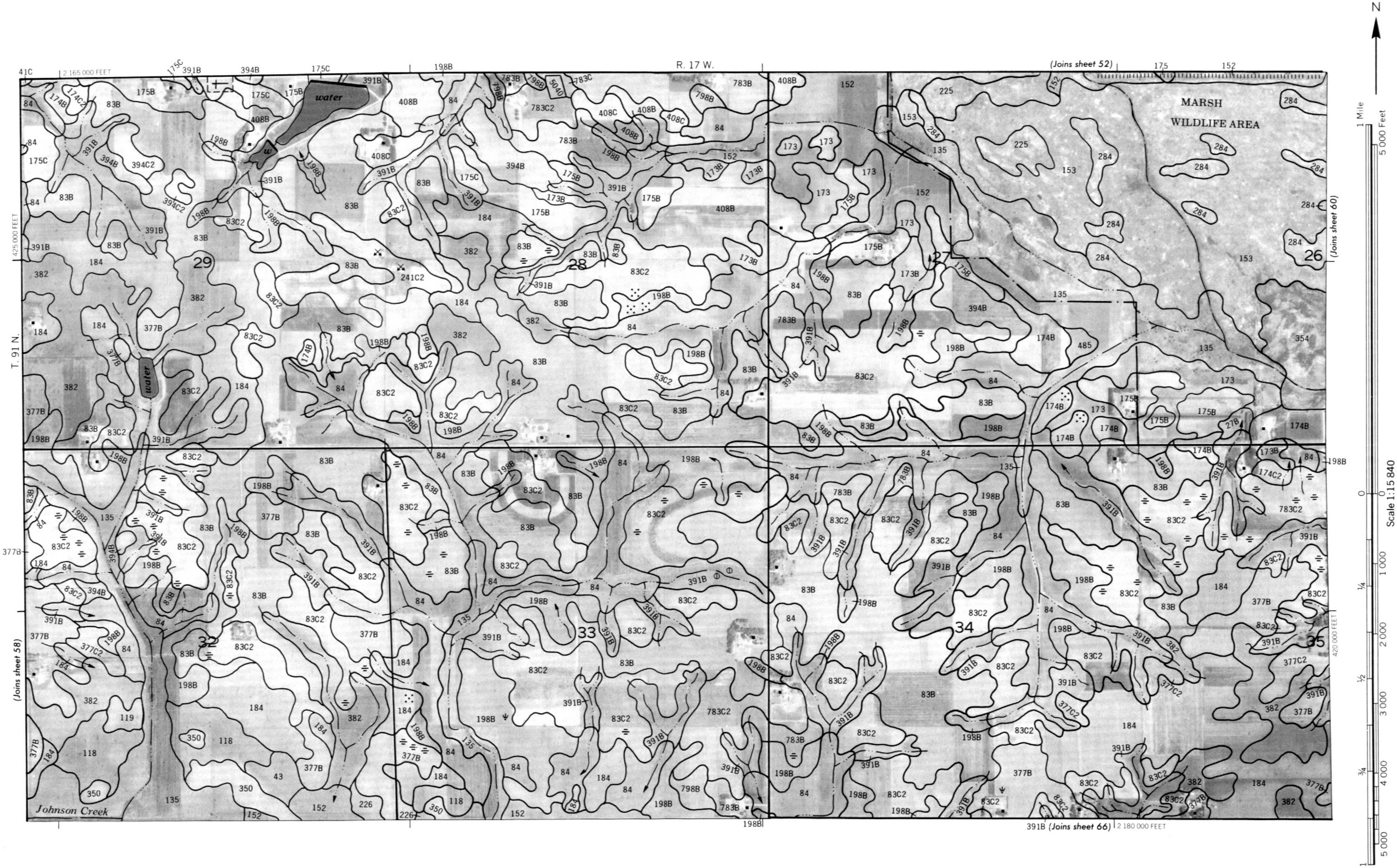

54
N
(Joins sheet 47)
R. 16 W.
2 215 000 FEET
T. 91 N.
435 000 FEET
(Joins sheet 55)
(Joins sheet 53)
430 000 FEET
(Joins sheet 61)
2 205 000 FEET
Feddeke
Creek
Landphere
Creek
16
15
14
13
21
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840


N
R. 16 W. | R. 15 W.
T. 91 N.
2 220 000 FEET
435 000 FEET
430 000 FEET
2 235 000 FEET
(Joins sheet 48)
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 54)
13
18
17
16
24
19
20
21
Landphere
Creek
McClure
Creek
McClure
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

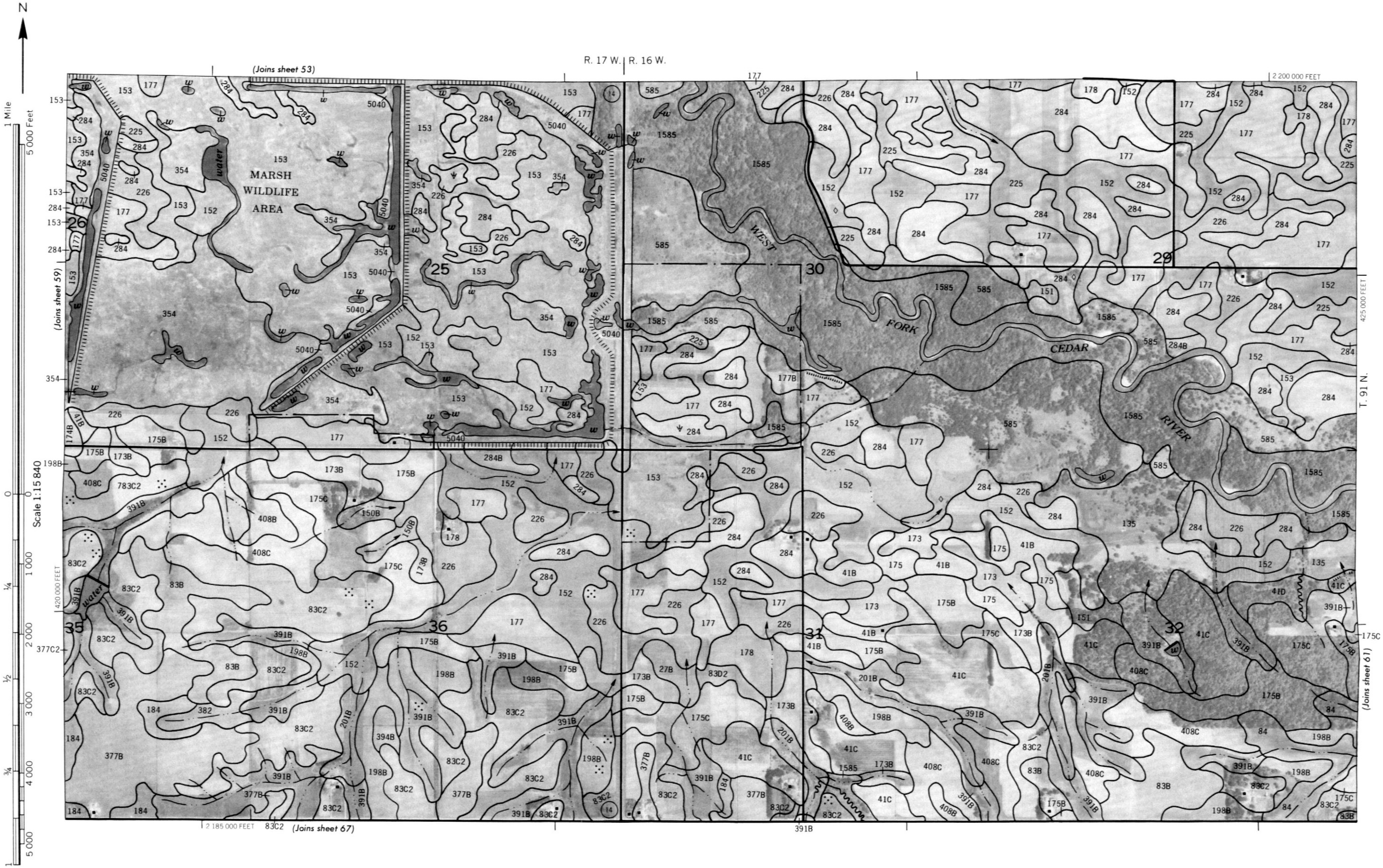

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 49)
(Joins sheet 55)
(Joins sheet 63)
R. 15 W.
T. 91 N.
2 255 000 FEET
2 240 000 FEET
435 000 FEET
430 000 FEET
SHELL ROCK RIVER
SHELL ROCK RIVER
BREMER COUNTY
15
14
13
22
23
24

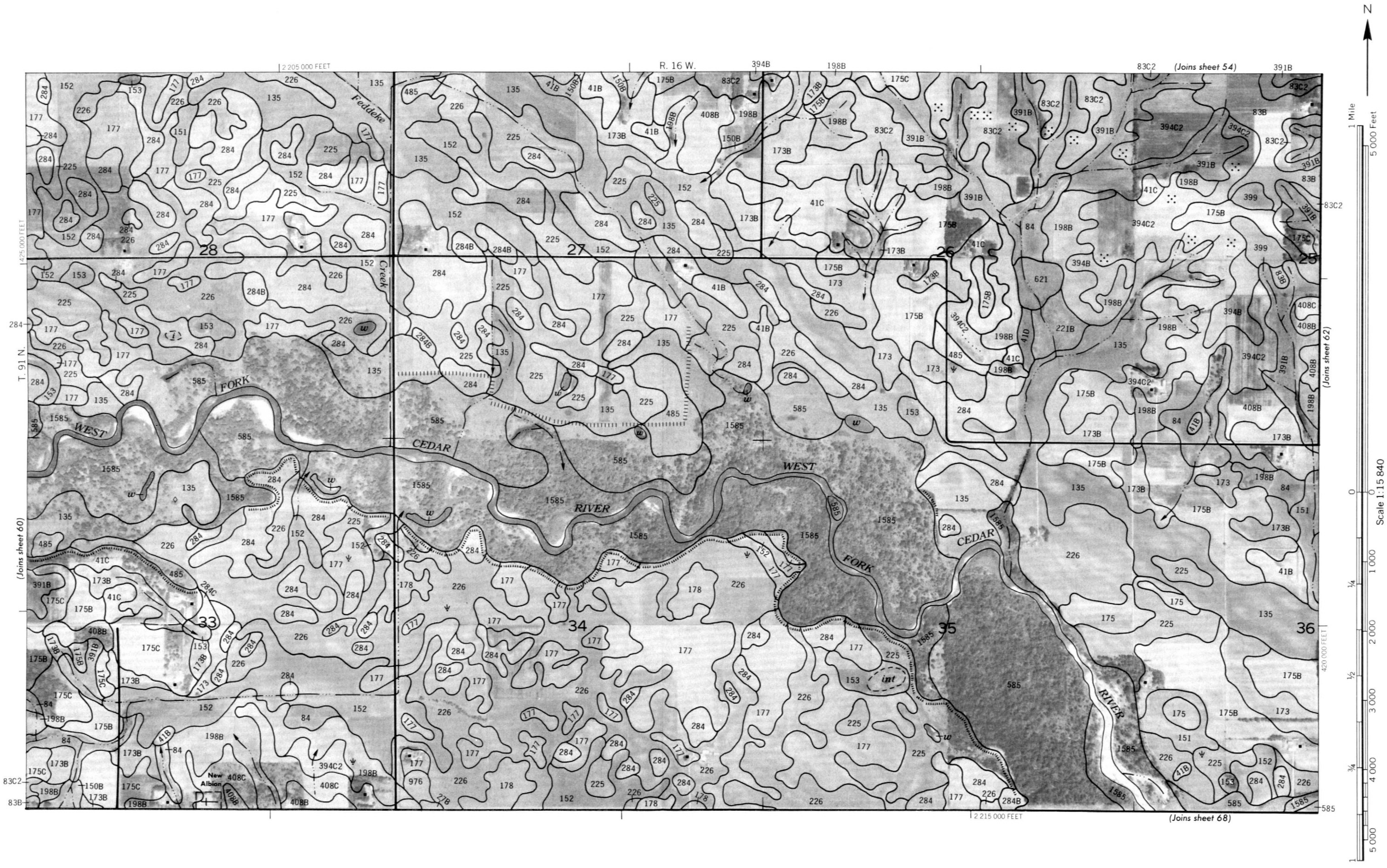

57
N
R. 18 W.
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 64)
T. 91 N.
FRANKLIN COUNTY
2 130 000 FEET
2 145 000 FEET
425 000 FEET
420 000 FEET
Johnson
Creek
Johnson
Creek
30
29
28
27
31
32
33
34
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

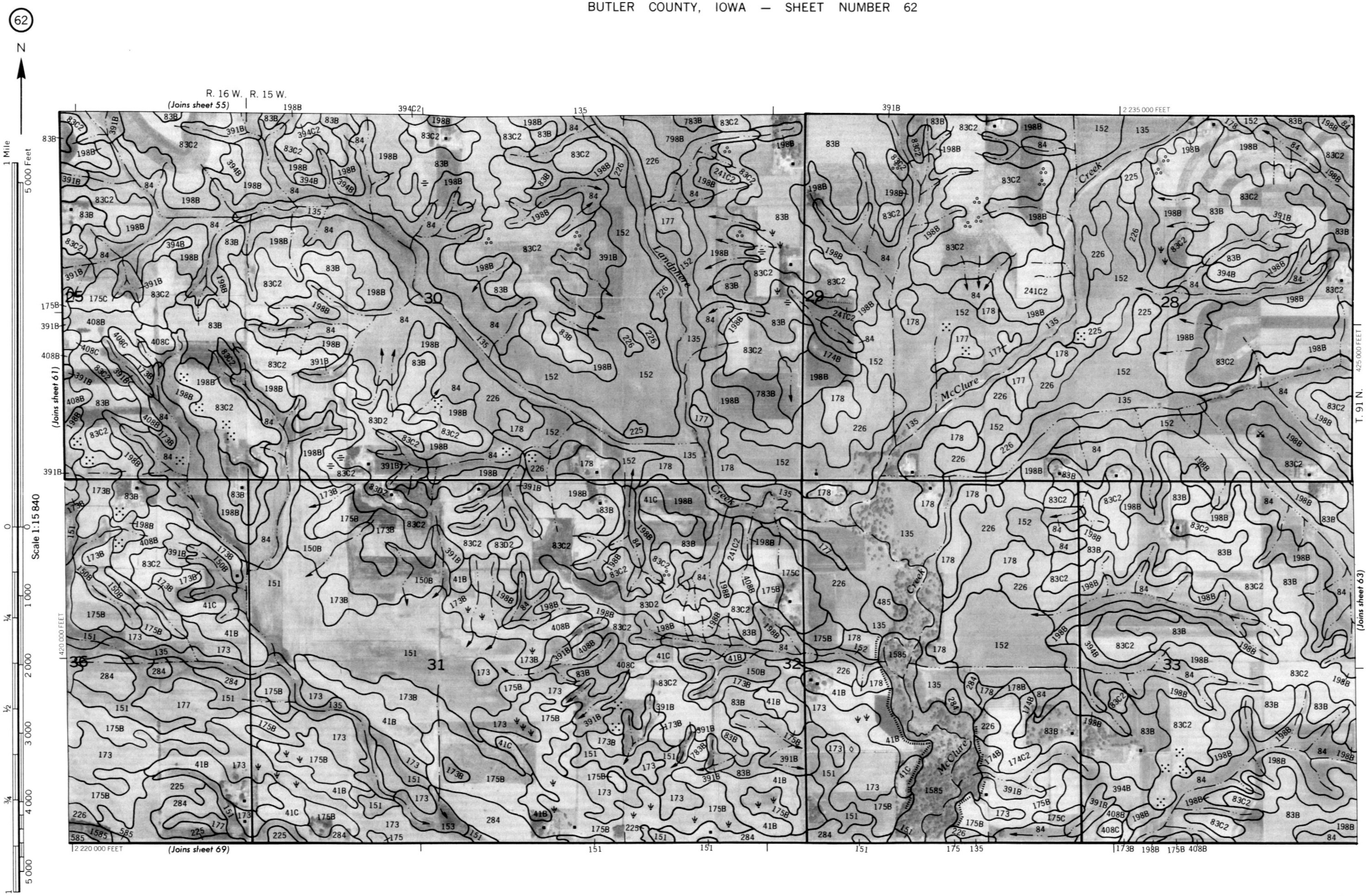

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 51)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
R. 18 W.
R. 17 W.
2 160 000 FEET
2 150 000 FEET
425 000 FEET
420 000 FEET
T. 91 N.
Kesley
Johnson Creek
27
26
25
30
34
35
36
31

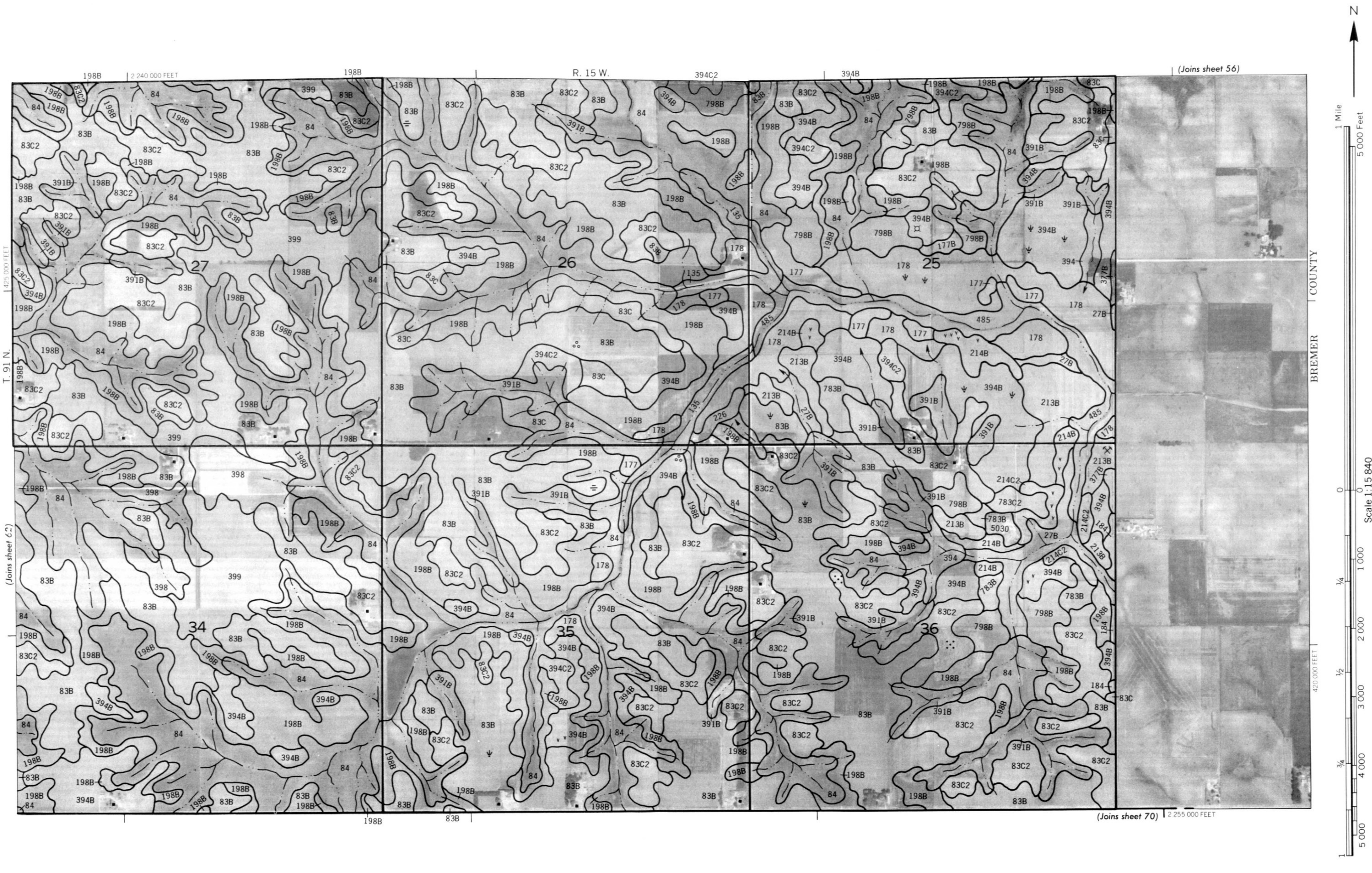

N
R. 17 W.
T. 91 N.
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 66)
MARSH
WILDLIFE AREA
Johnson Creek
water
2 165 000 FEET
2 180 000 FEET
425 000 FEET
420 000 FEET
29
28
27
26
32
33
34
35
1 Mile
5 000 Feet
Scale 1:15 840

BUTLER COUNTY, IOWA — SHEET NUMBER 60

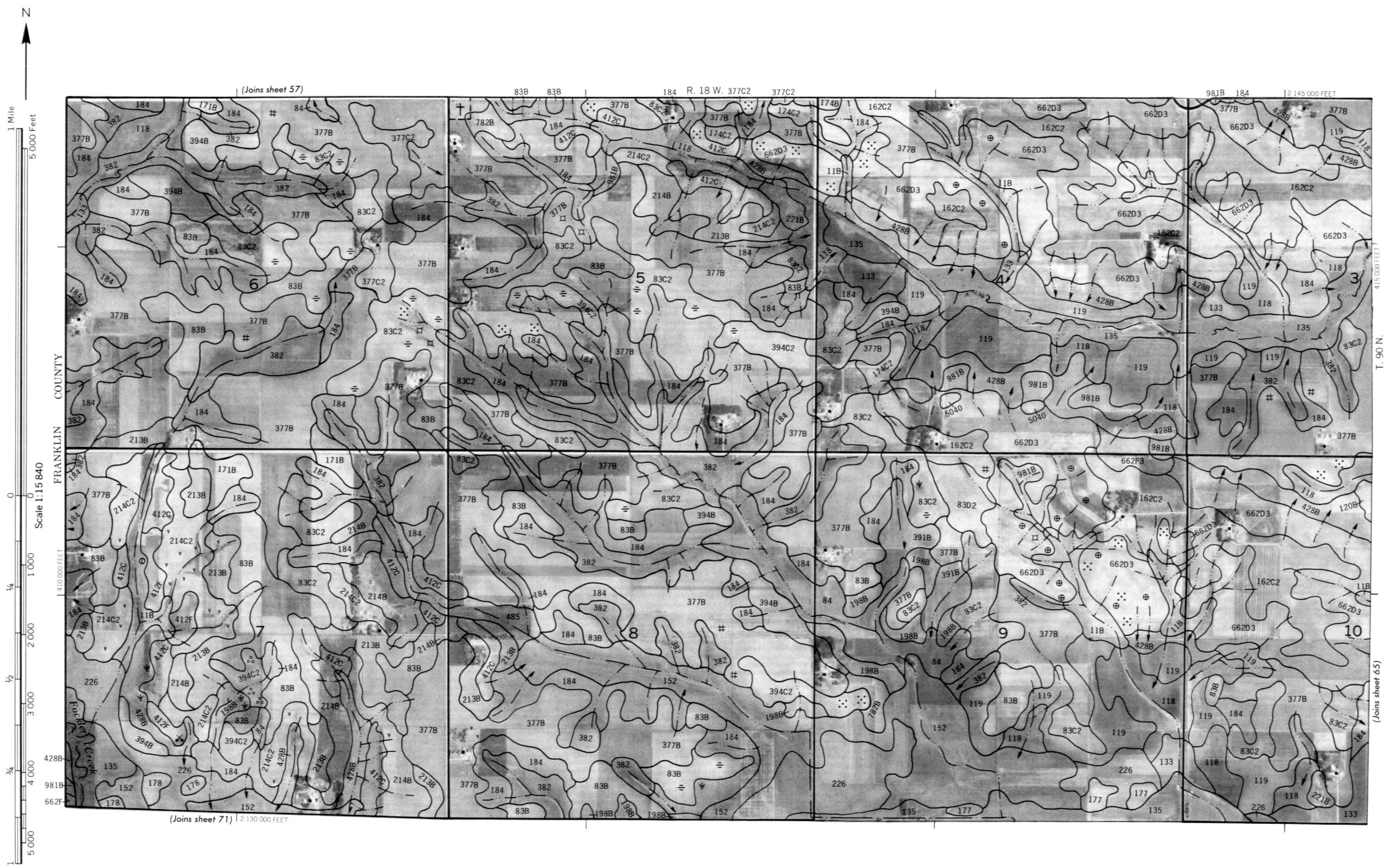


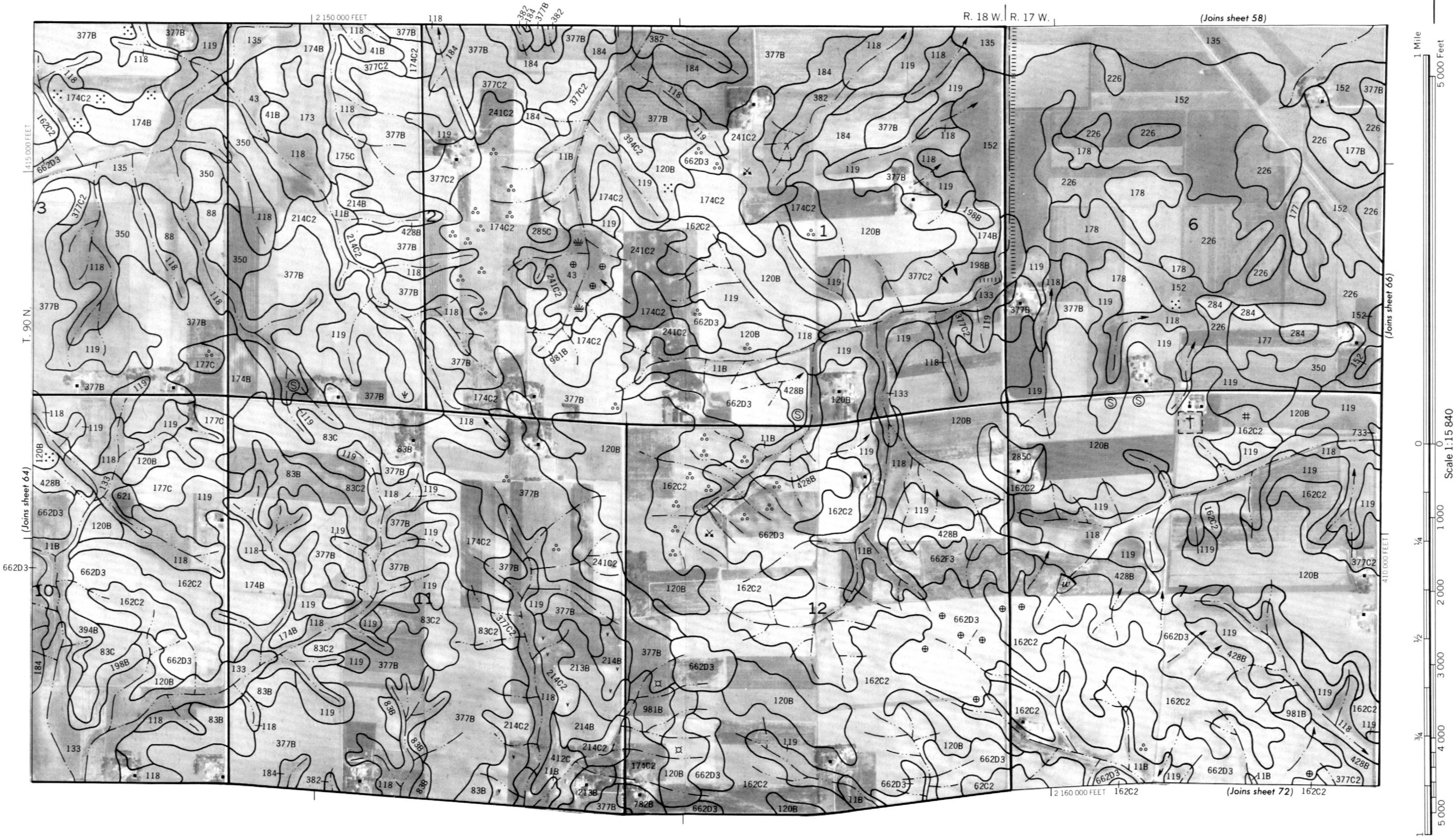

61
N
R. 16 W.
T. 91 N.
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 68)
(Joins sheet 60)
2 205 000 FEET
2 215 000 FEET
425 000 FEET
420 000 FEET
Feddeke Creek
WEST FORK CEDAR RIVER
New Albion
28
27
26
25
33
34
35
36
Scale 1:15 840
1 Mile
5 000 Feet

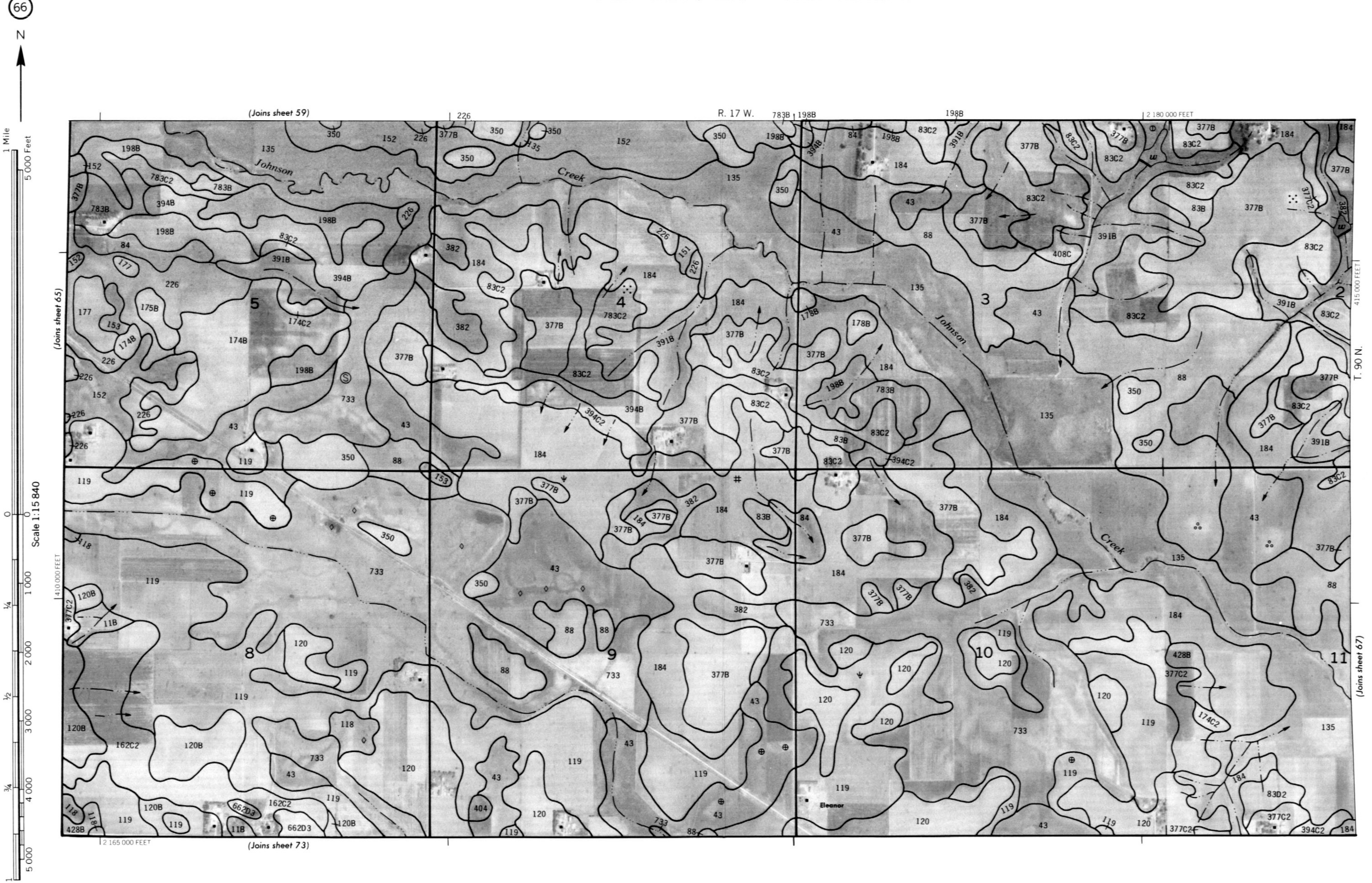

62
N
1 Mile
5 000 Feet
Scale 1:15 840
R. 16 W.
R. 15 W.
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
T. 91 N.
2 235 000 FEET
425 000 FEET
420 000 FEET
2 220 000 FEET
25
30
29
28
36
31
32
33
Landphere Creek
McClure Creek

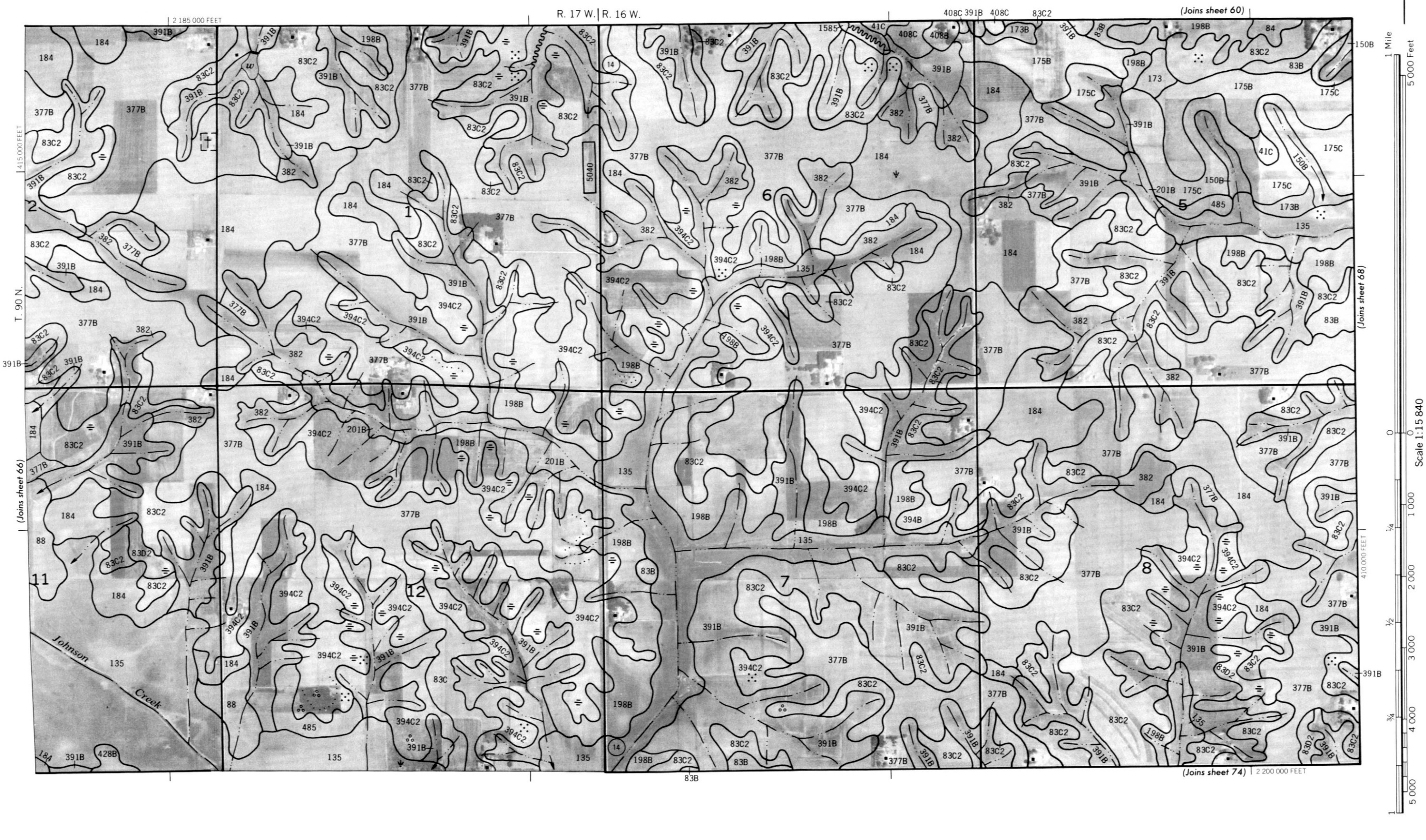

N
R. 15 W.
T. 91 N.
2 240 000 FEET
2 255 000 FEET
425 000 FEET
420 000 FEET
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 70)
BREMER COUNTY
27
26
25
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

BUTLER COUNTY, IOWA — SHEET NUMBER 64



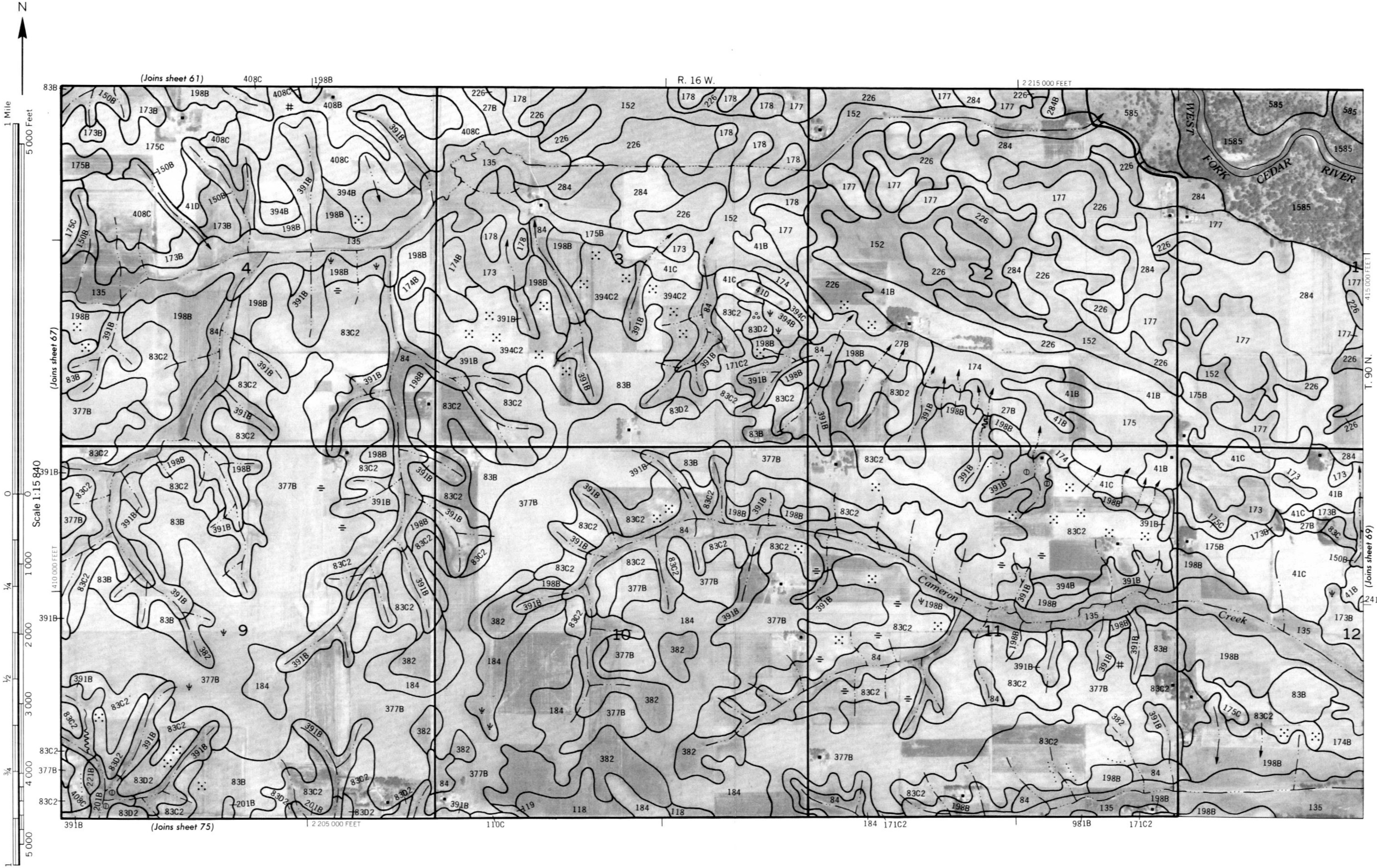

65
N
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 72)
R. 18 W.
R. 17 W.
T. 90 N.
2 150 000 FEET
2 160 000 FEET
415 000 FEET
410 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

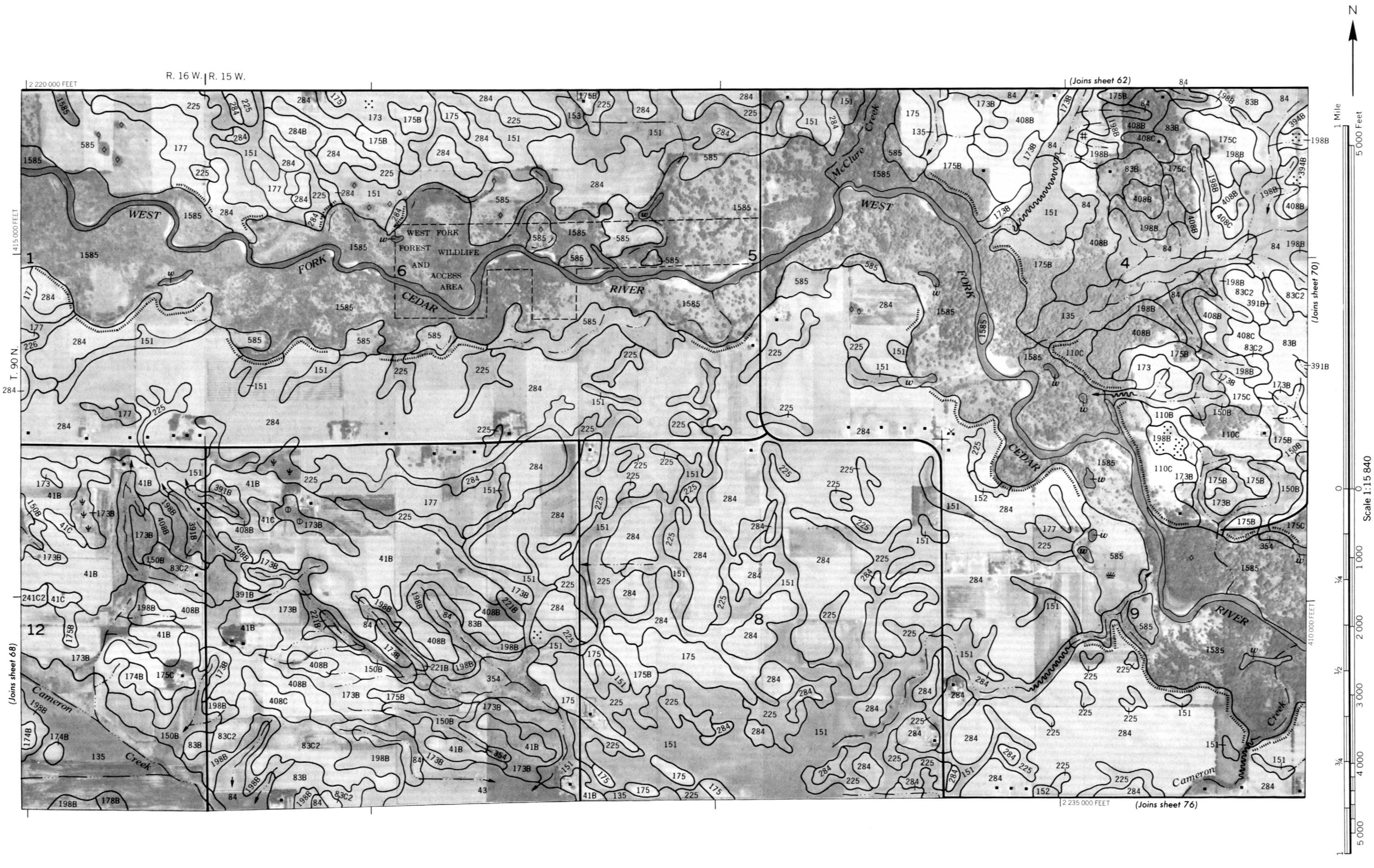

66
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 59)
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 73)
R. 17 W.
T. 90 N.
2 180 000 FEET
415 000 FEET
410 000 FEET
2 165 000 FEET
Johnson Creek
Eleanor

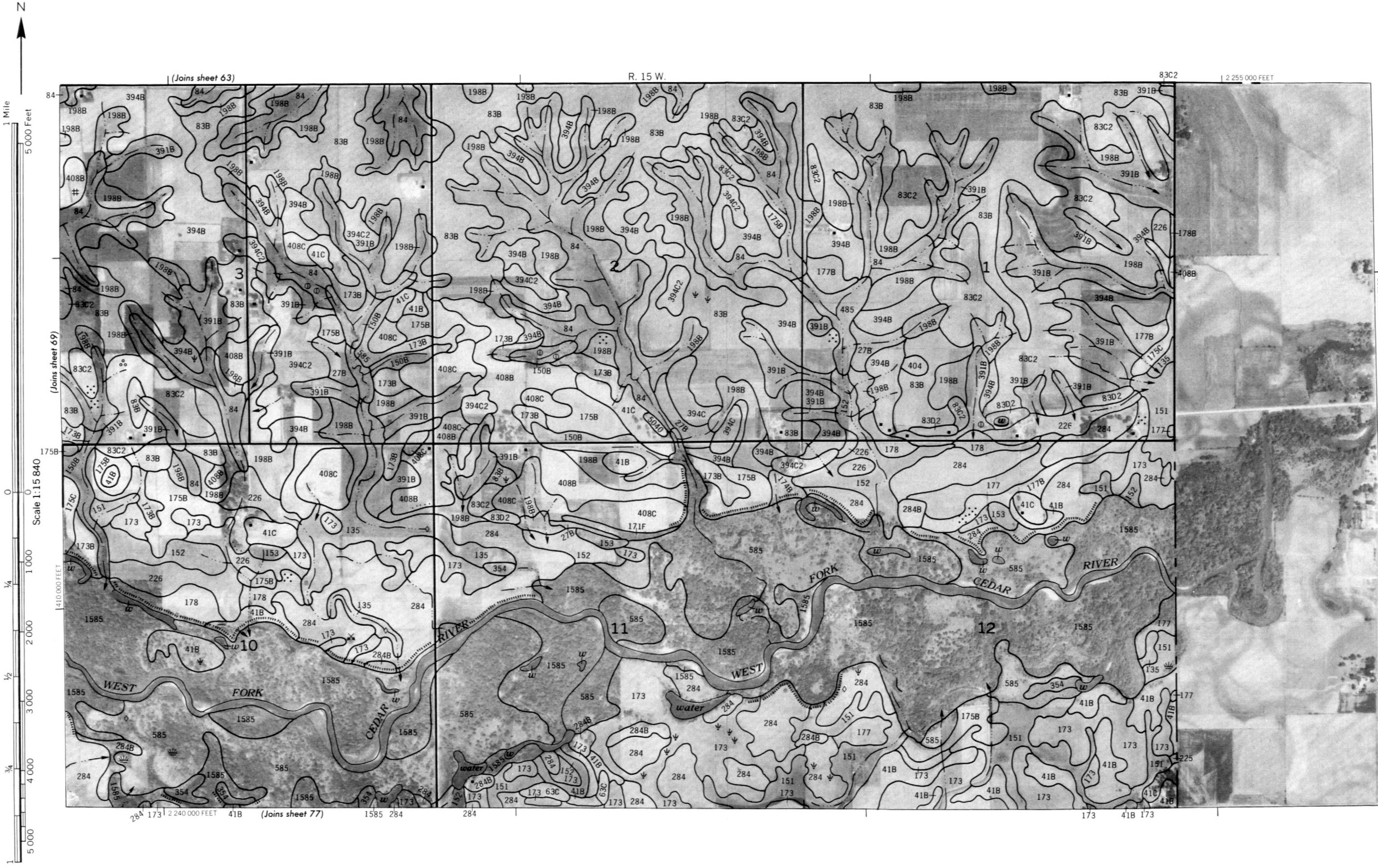

N
R. 17 W. | R. 16 W.
T. 90 N.
(Joins sheet 60)
(Joins sheet 68)
(Joins sheet 74)
(Joins sheet 66)
2 185 000 FEET
2 200 000 FEET
415 000 FEET
410 000 FEET
Johnson Creek
1 Mile
5 000 Feet
Scale 1:15 840

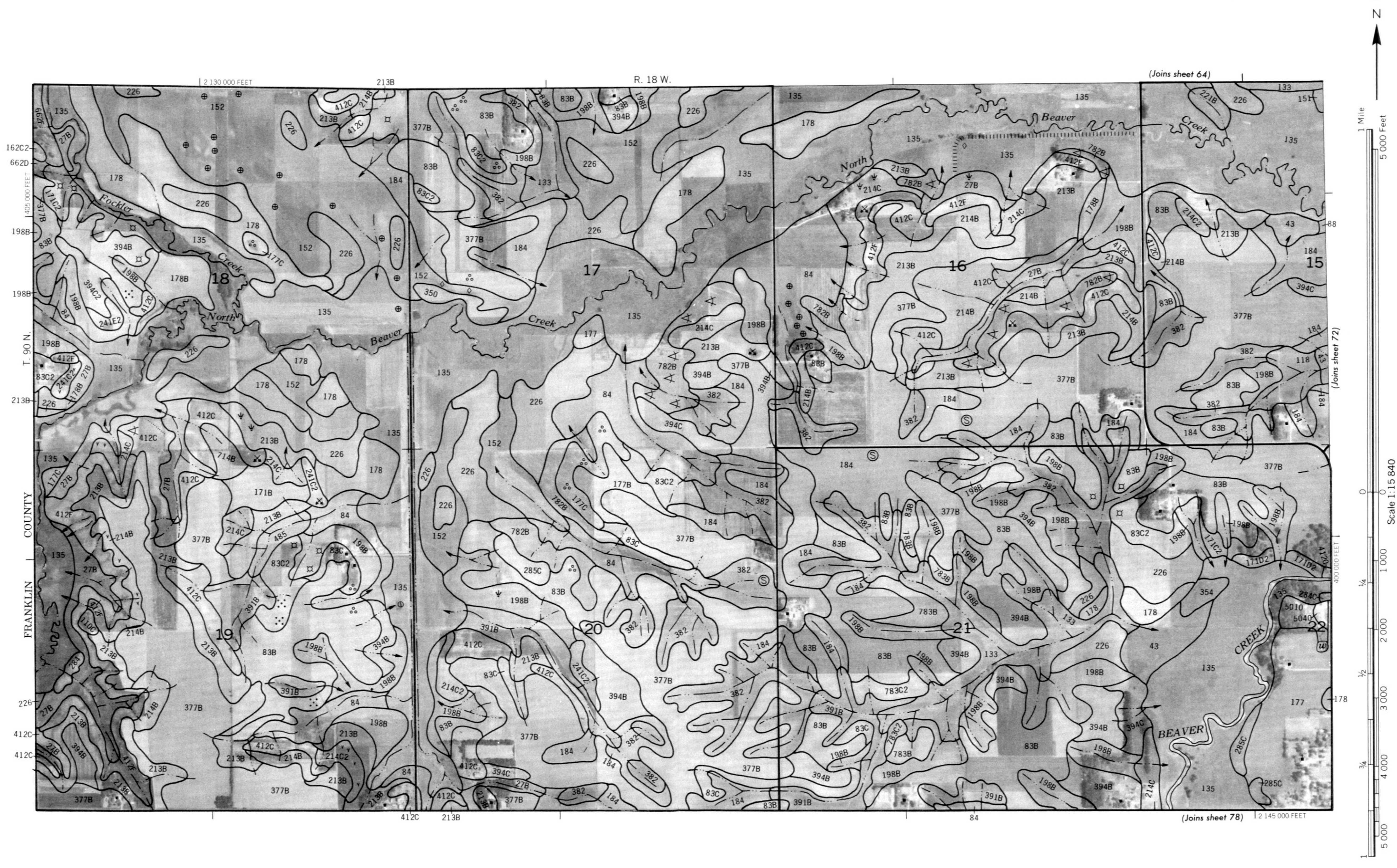
68

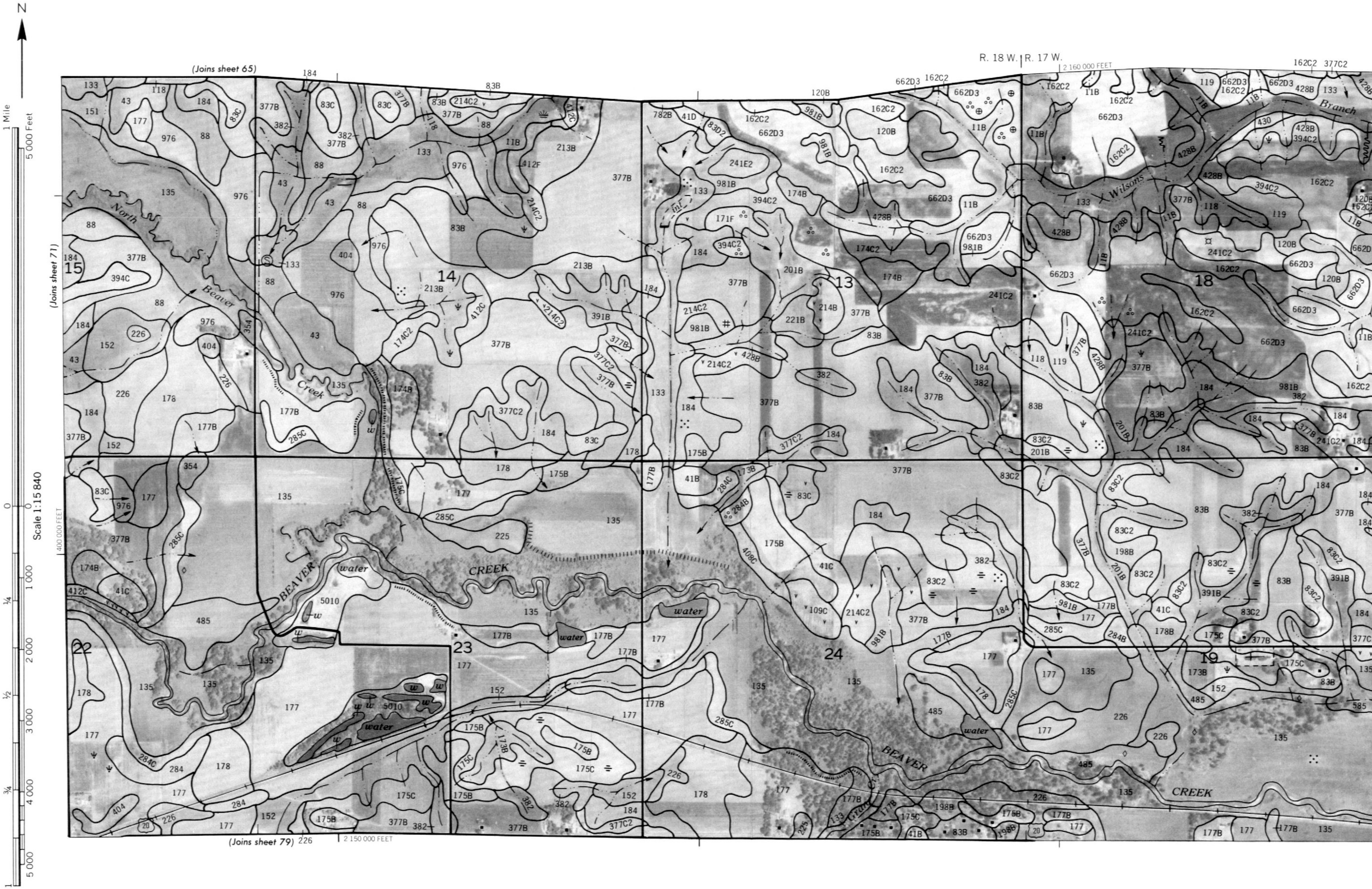
BUTLER COUNTY, IOWA — SHEET NUMBER 68

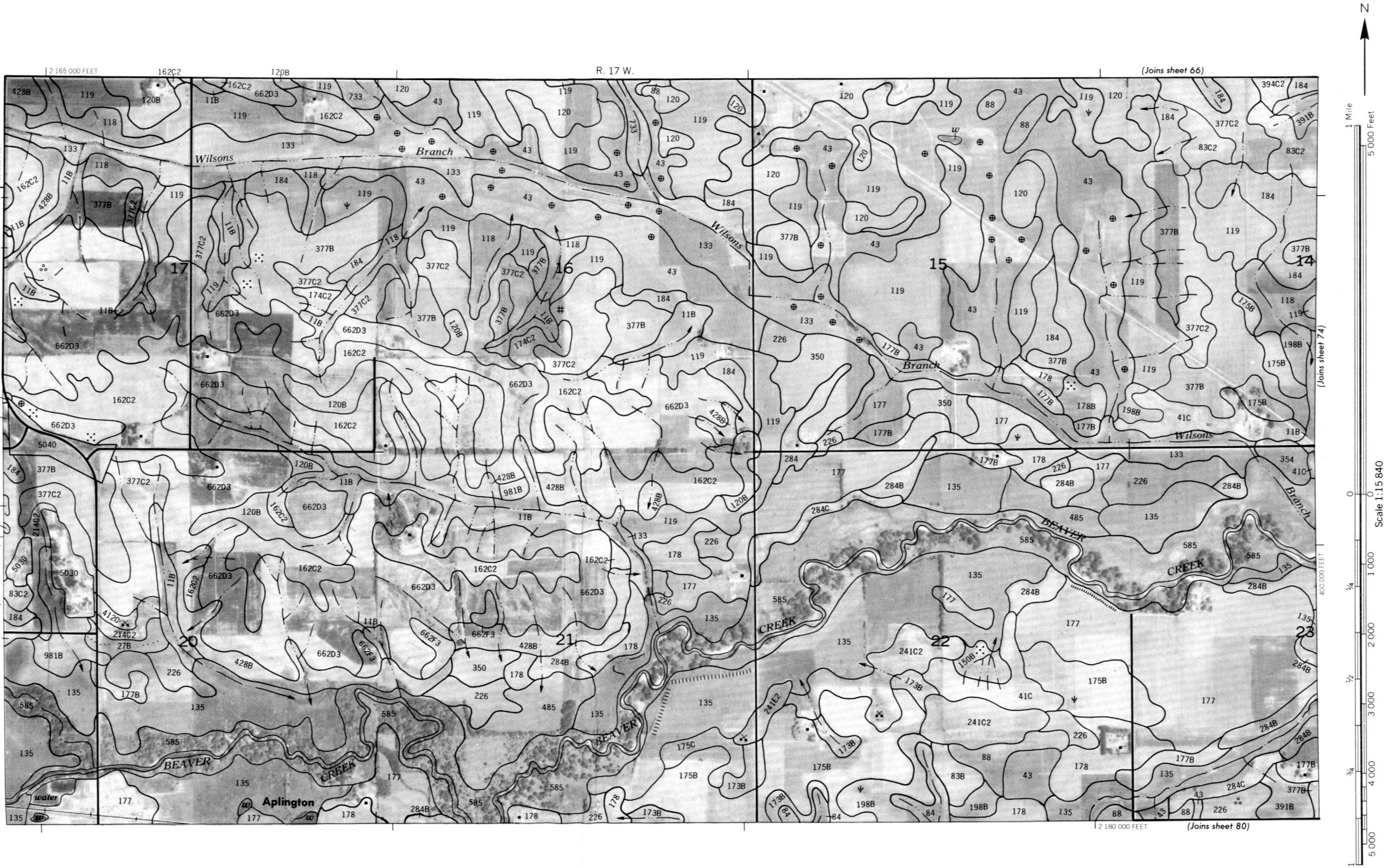


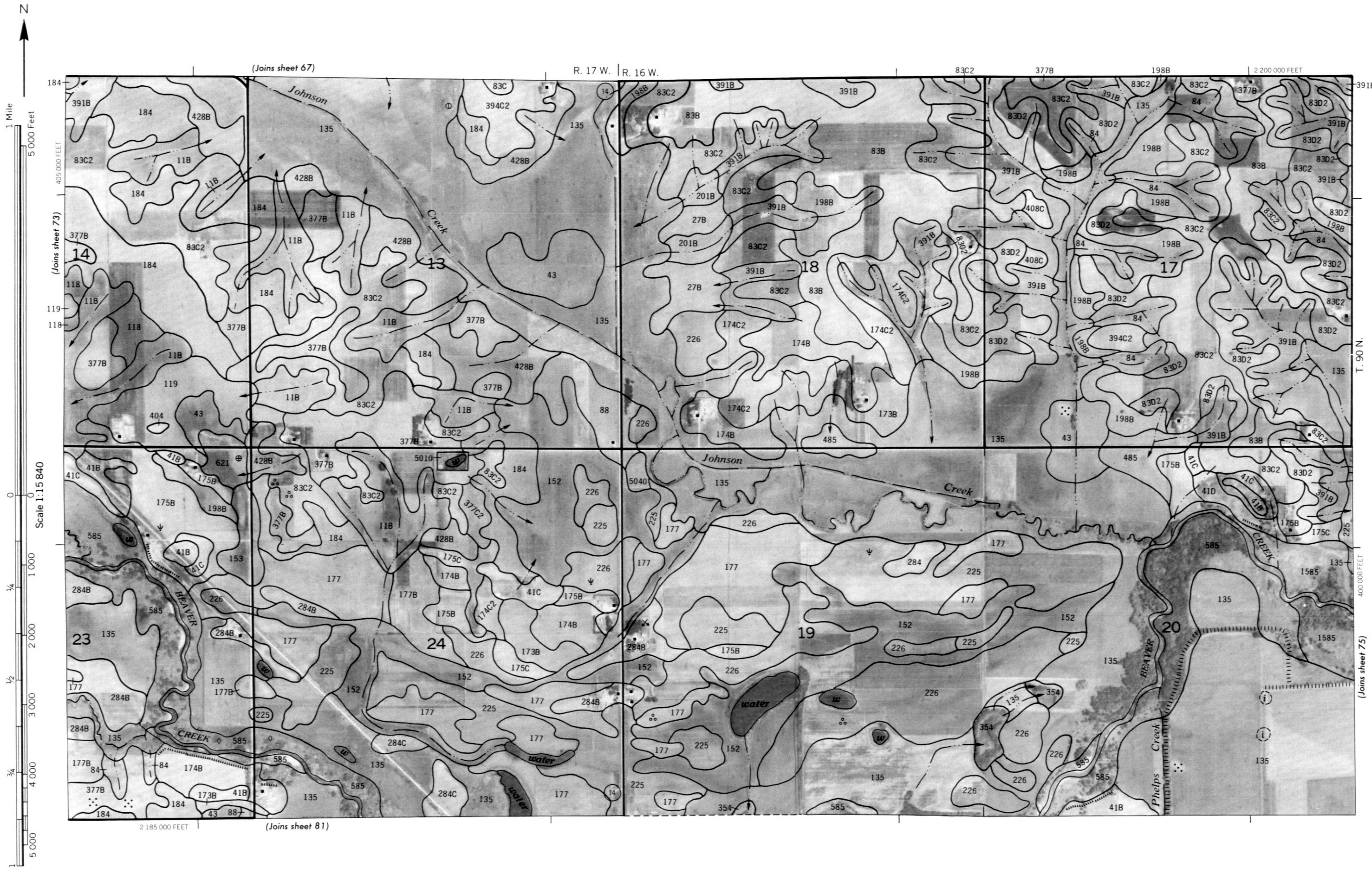

N
R. 16 W. | R. 15 W.
2 220 000 FEET
(Joins sheet 62)
(Joins sheet 70)
(Joins sheet 76)
(Joins sheet 68)
T. 90 N.
415 000 FEET
410 000 FEET
2 235 000 FEET
WEST FORK CEDAR RIVER
WEST FORK FOREST WILDLIFE AND ACCESS AREA
McClure Creek
Cameron Creek
1 Mile
5 000 Feet
Scale 1:15 840

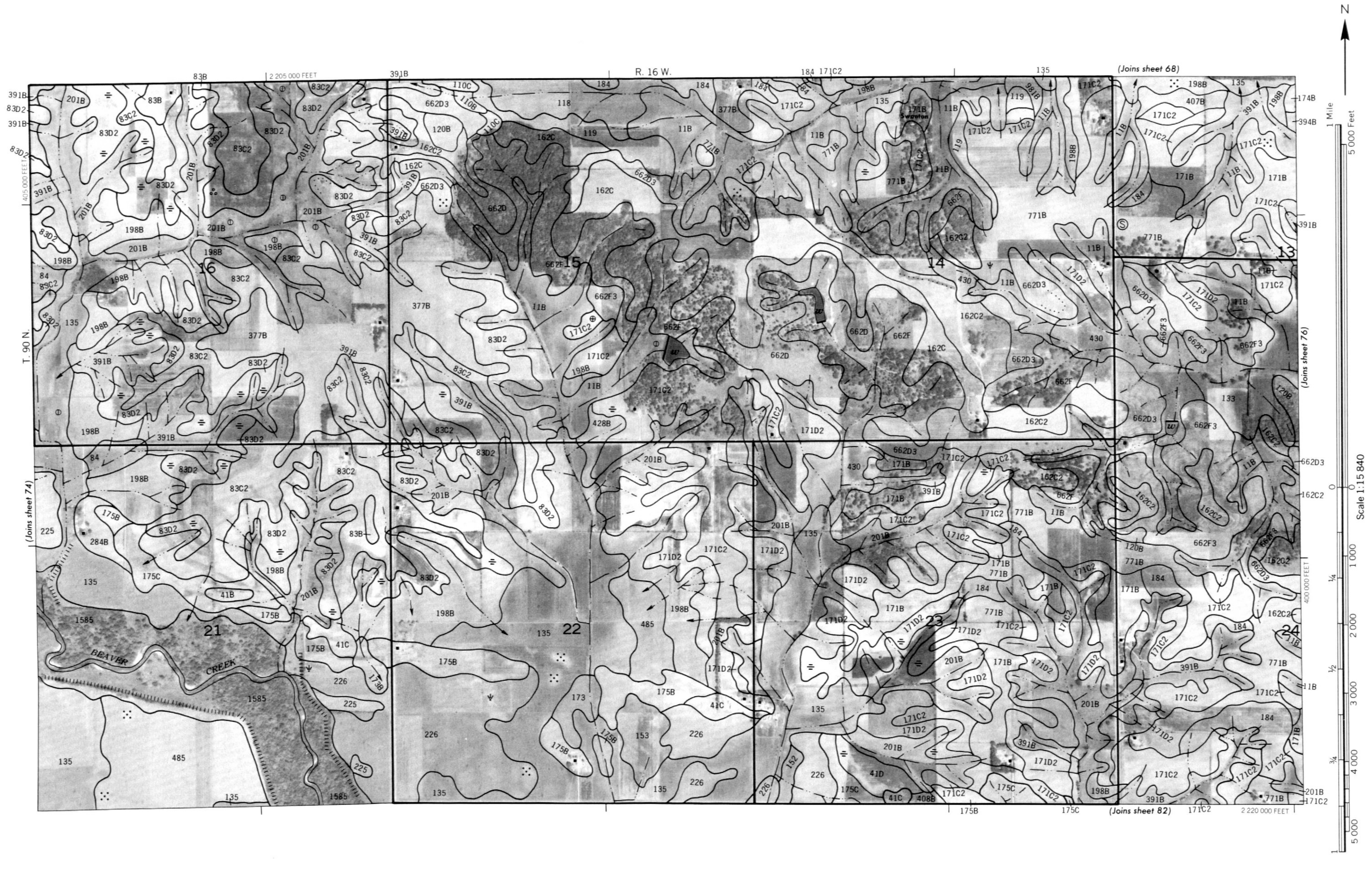

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 63)
R. 15 W.
2 255 000 FEET
415 000 FEET
T. 90 N.
BLACK HAWK COUNTY
(Joins sheet 69)
410 000 FEET
2 240 000 FEET
(Joins sheet 77)
WEST FORK CEDAR RIVER
water
1
2
3
10
11
12

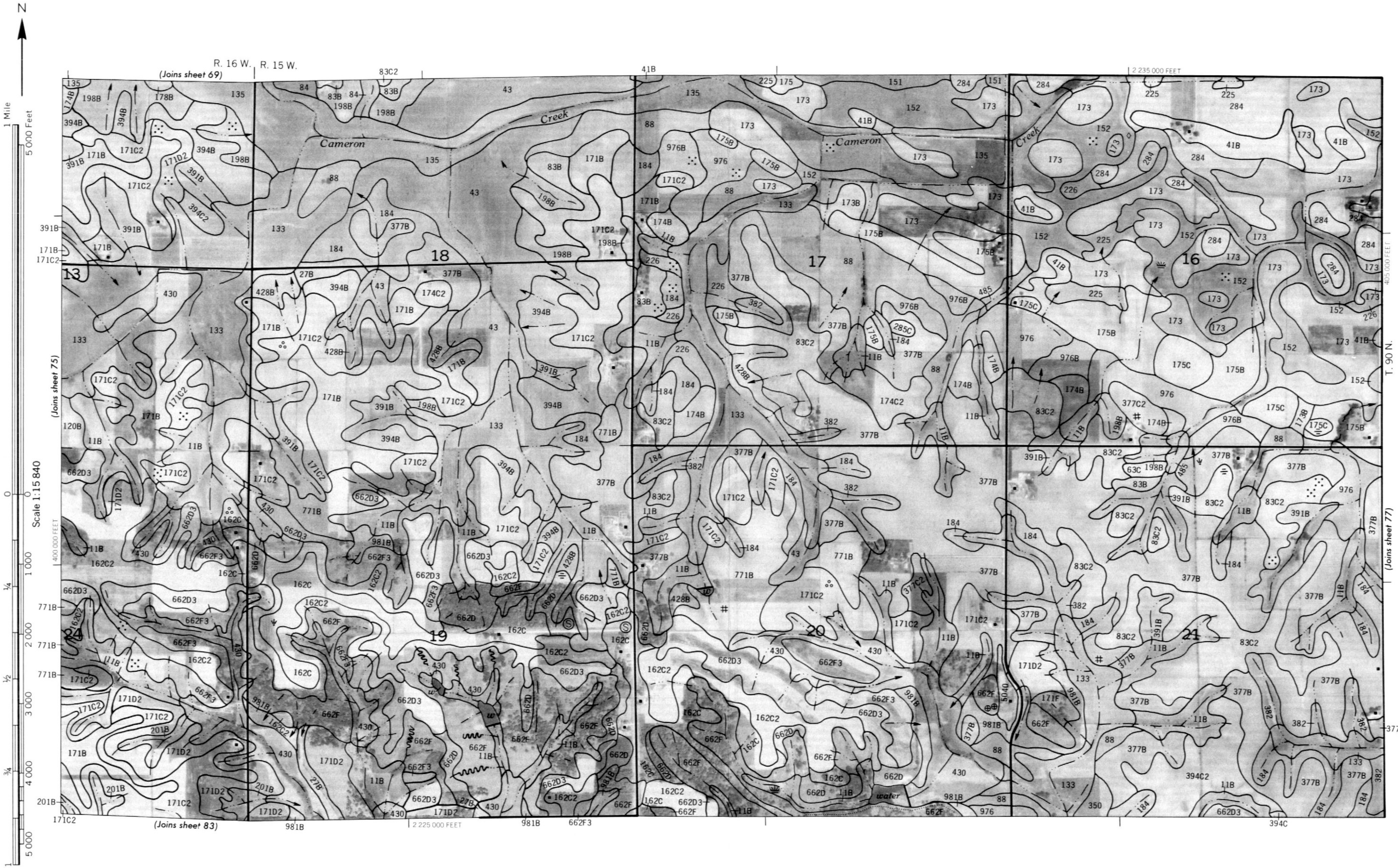

N
(Joins sheet 64)
R. 18 W.
2 130 000 FEET
405 000 FEET
T. 90 N.
FRANKLIN COUNTY
(Joins sheet 72)
(Joins sheet 78)
2 145 000 FEET
400 000 FEET
18
17
16
15
19
20
21
22
Fockler Creek
North Beaver Creek
BEAVER CREEK
Scale 1:15 840
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000

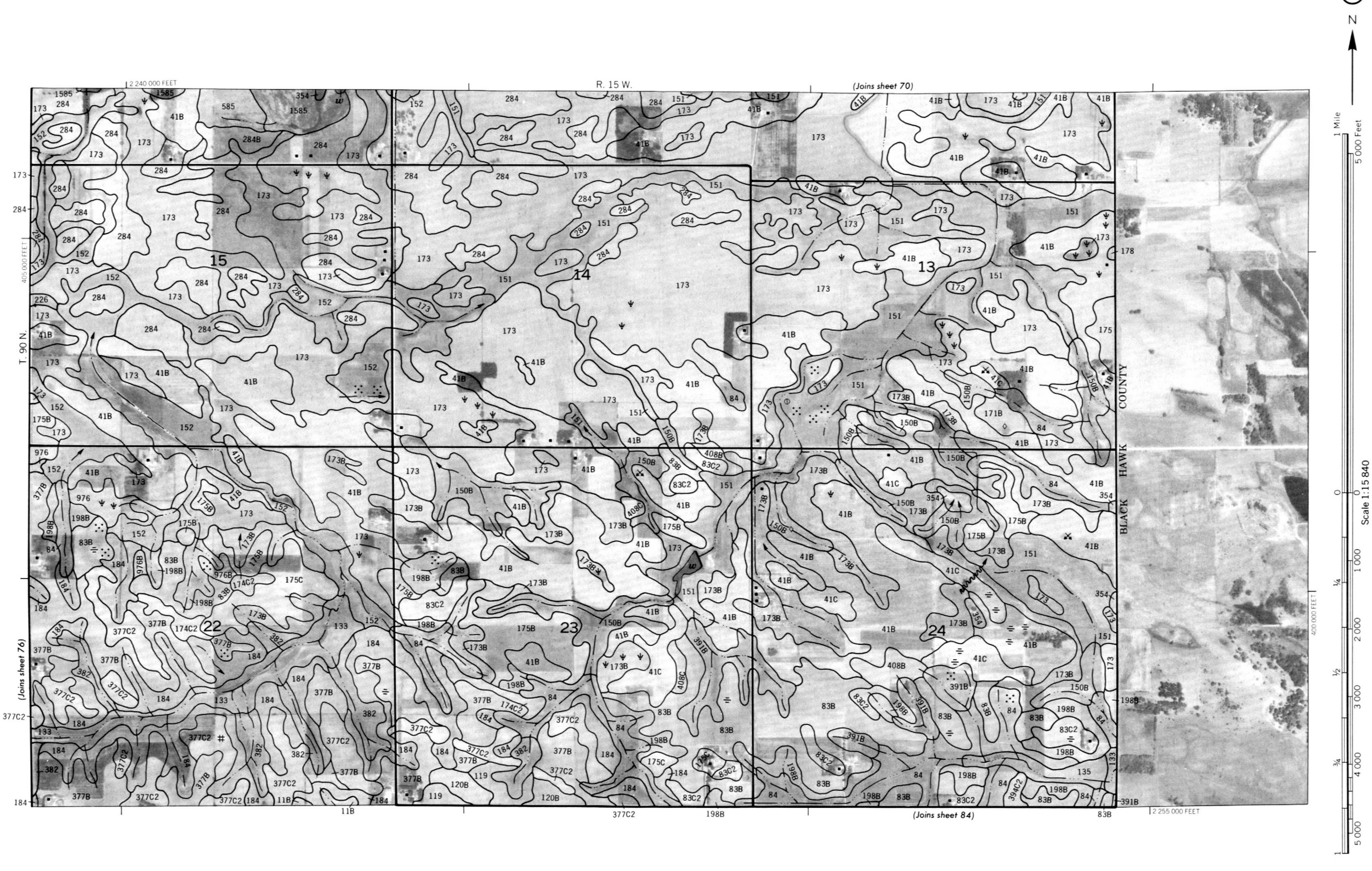

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 65)
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 79)
R. 18 W. | R. 17 W.
T. 90 N.
2 160 000 FEET
2 150 000 FEET
405 000 FEET
400 000 FEET
North Beaver Creek
BEAVER CREEK
Wilsons Branch
water
15
14
13
18
22
23
24
19

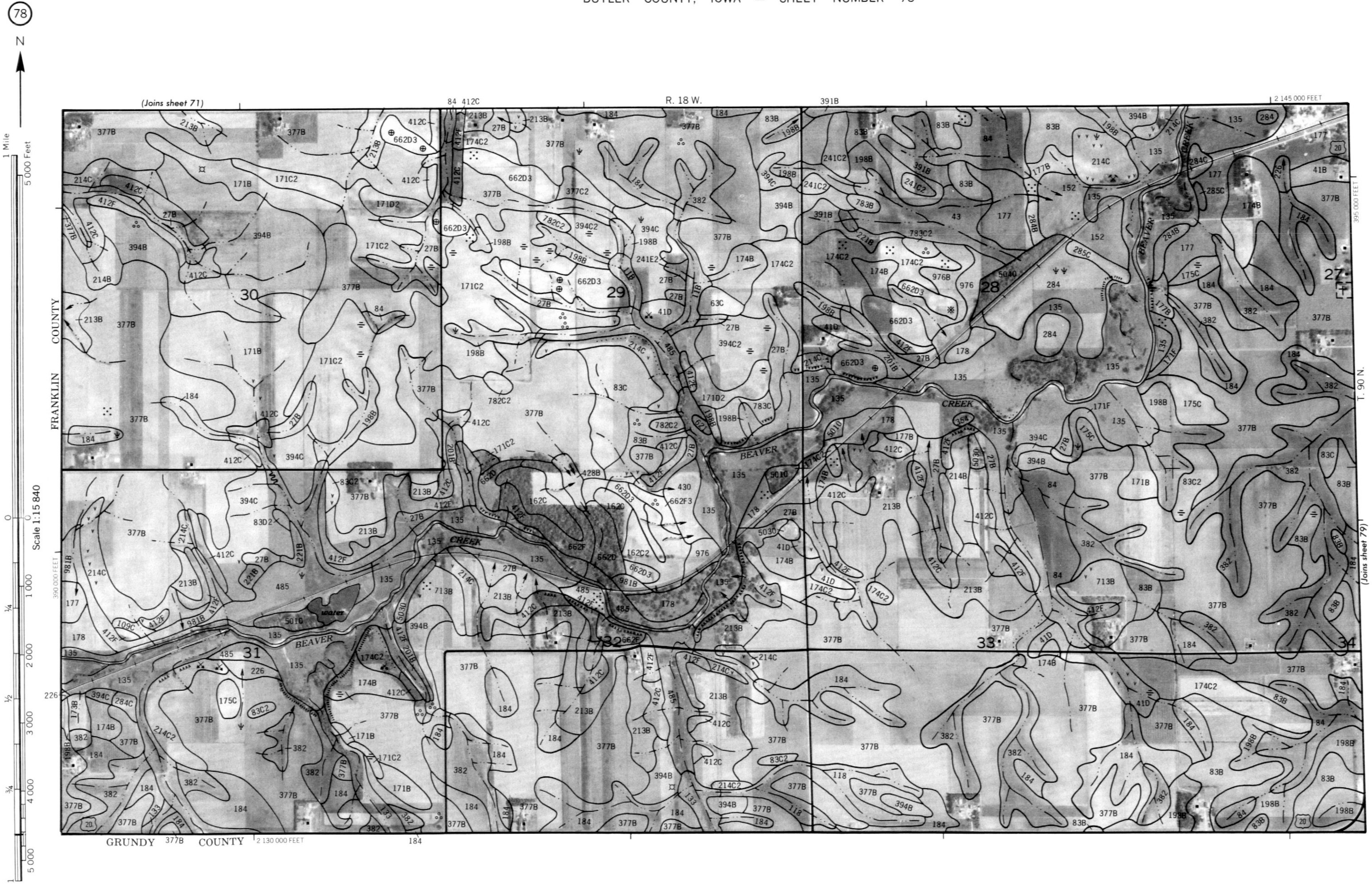

N
R. 17 W.
T. 90 N.
(Joins sheet 66)
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 80)
2 165 000 FEET
2 180 000 FEET
405 000 FEET
400 000 FEET
Wilsons
Branch
Wilsons
Branch
Wilsons
Branch
BEAVER
CREEK
BEAVER
CREEK
BEAVER
CREEK
Aplington
water
17
16
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

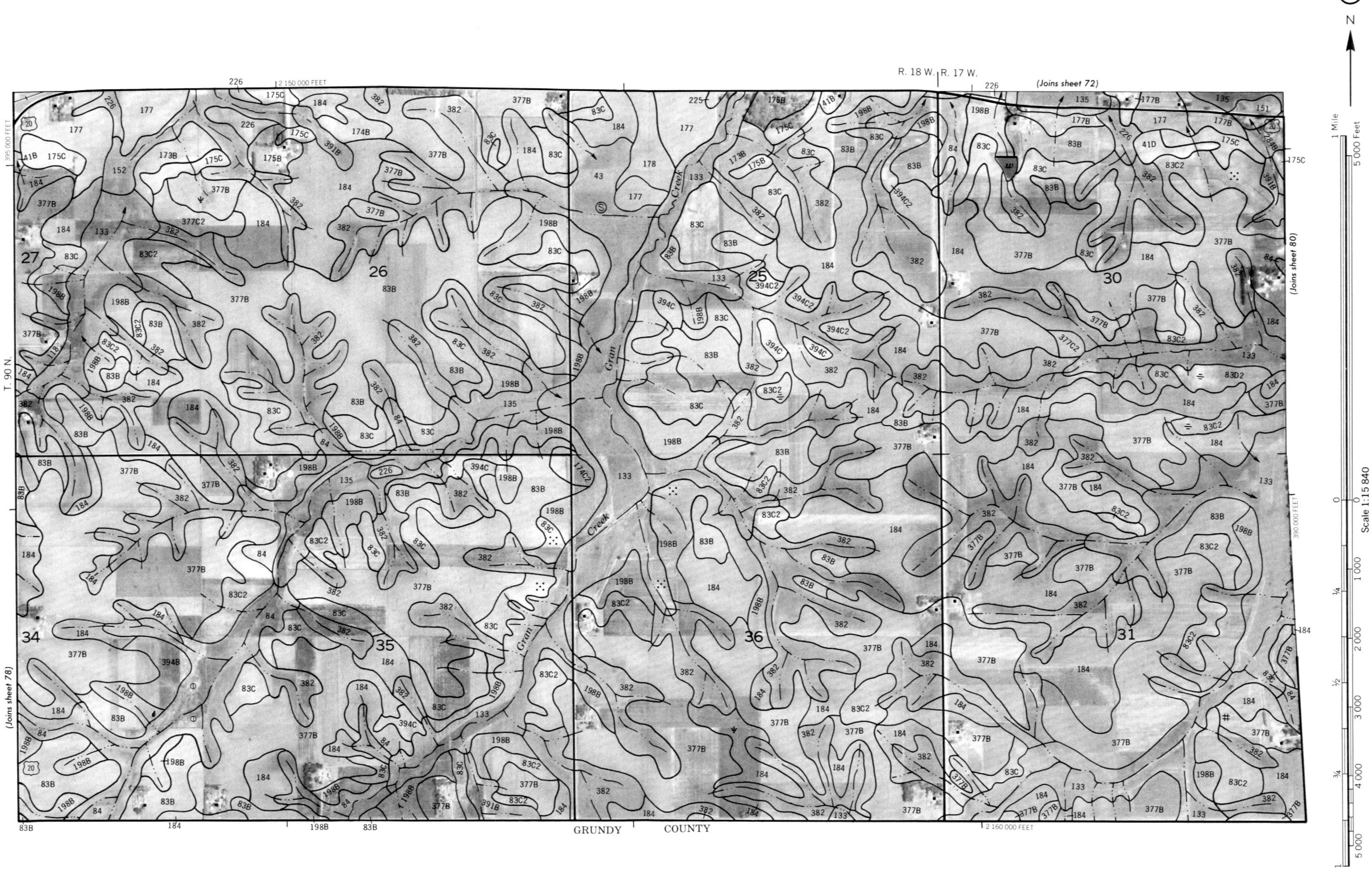

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 67)
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 81)
R. 17 W.
R. 16 W.
T. 90 N.
405 000 FEET
400 000 FEET
2 185 000 FEET
2 200 000 FEET
Johnson Creek
BEAVER CREEK
Phelps Creek
14
13
18
17
23
24
19
20
water

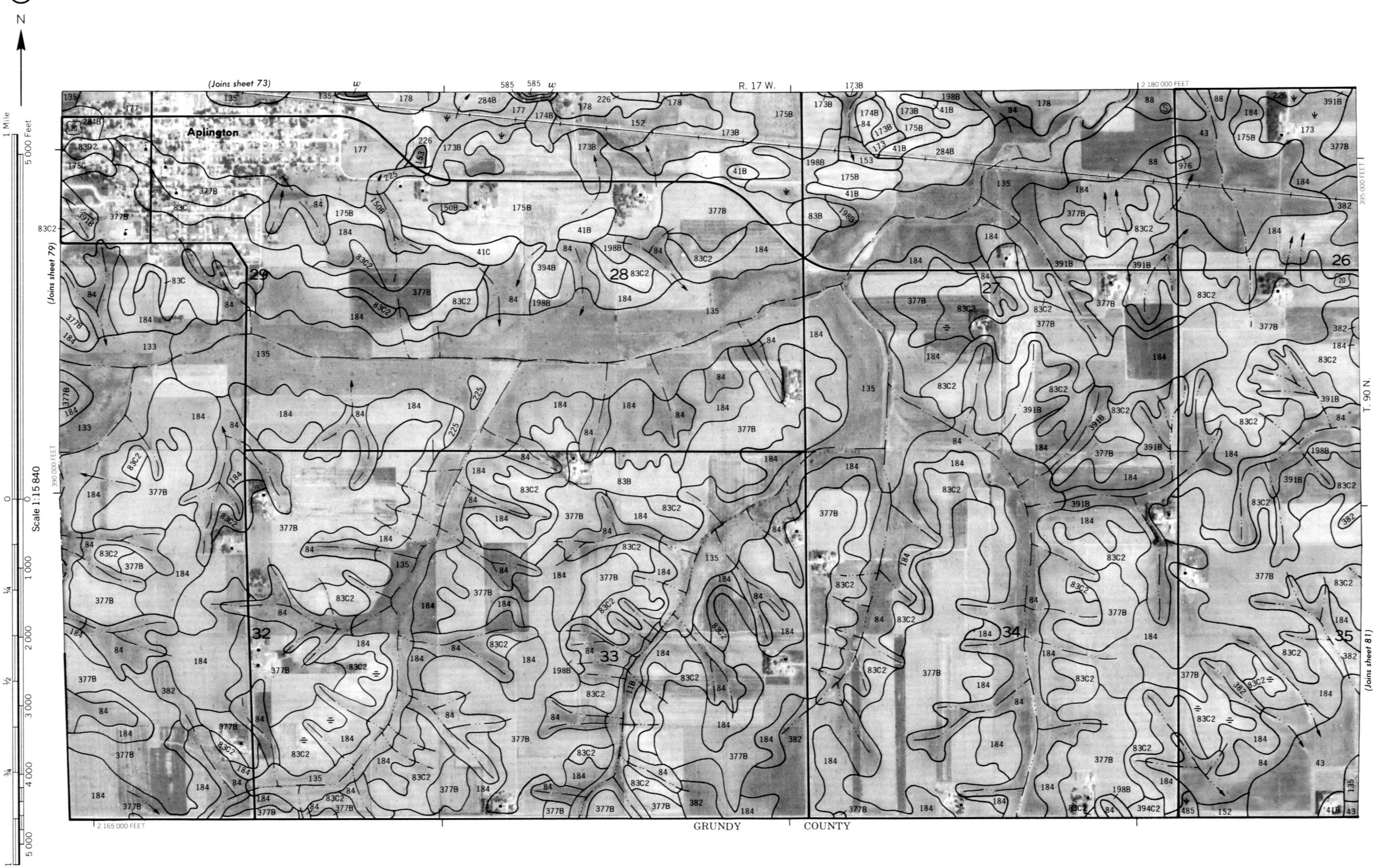

N
R. 16 W.
T. 90 N.
2 205 000 FEET
2 220 000 FEET
405 000 FEET
400 000 FEET
(Joins sheet 68)
(Joins sheet 76)
(Joins sheet 82)
(Joins sheet 74)
BEAVER
CREEK
Swanton
13
14
15
16
21
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

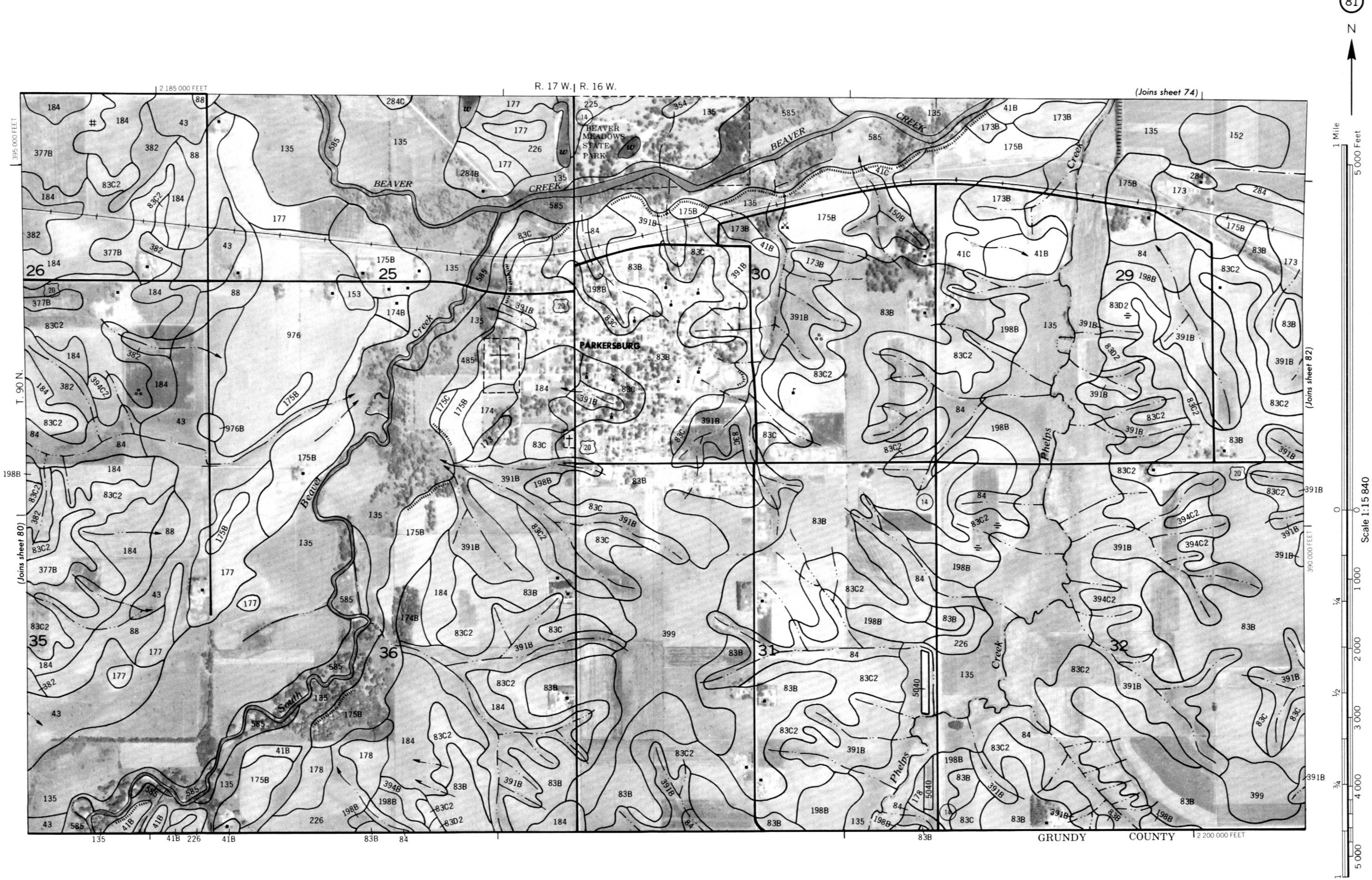

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 16 W.
R. 15 W.
(Joins sheet 69)
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 83)
T. 90 N.
Cameron Creek
2 235 000 FEET
2 225 000 FEET
405 000 FEET
400 000 FEET
13
18
17
16
24
19
20
21


N
2 240 000 FEET
R. 15 W.
(Joins sheet 70)
T. 90 N.
405 000 FEET
(Joins sheet 76)
BLACK HAWK COUNTY
(Joins sheet 84)
2 255 000 FEET
400 000 FEET
15
14
13
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

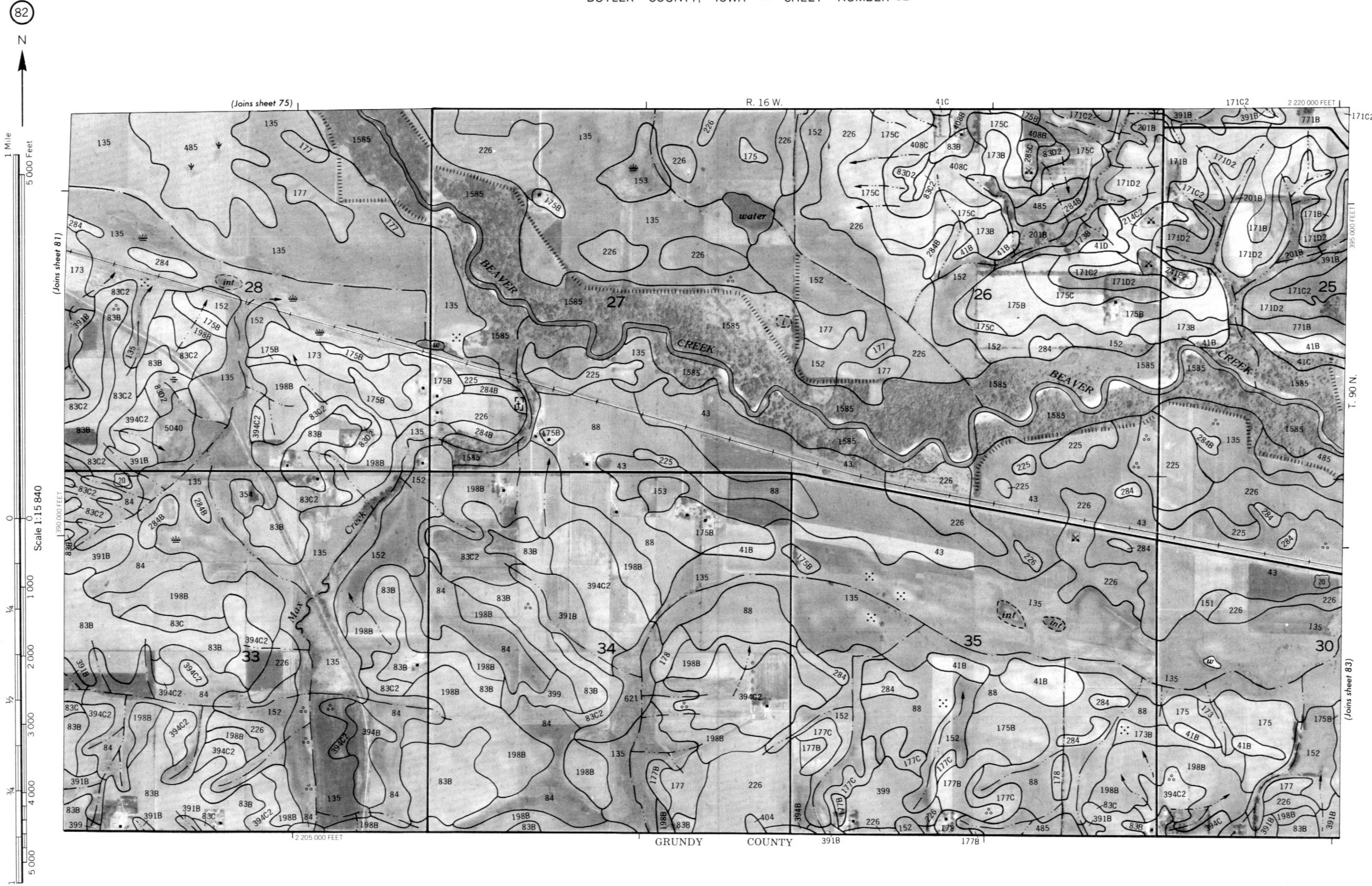

78
N
1 Mile
5 000 Feet
0
Scale 1:15 840
1 000
2 000
3 000
4 000
5 000
(Joins sheet 71)
R. 18 W.
2 145 000 FEET
395 000 FEET
T. 90 N.
(Joins sheet 79)
390 000 FEET
2 130 000 FEET
FRANKLIN COUNTY
GRUNDY COUNTY
BEAVER CREEK
water
27
28
29
30
31
32
33
34

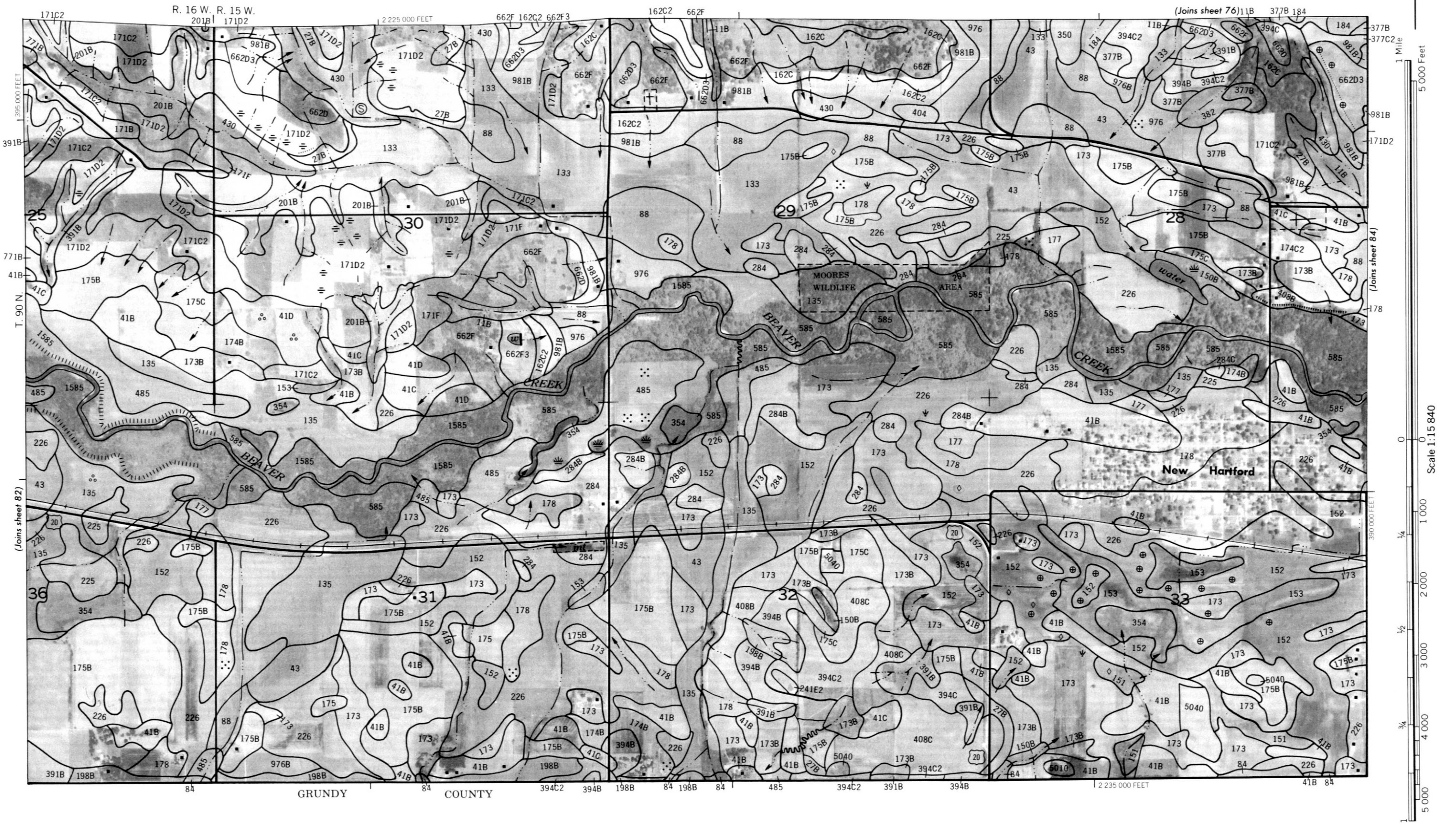

79
N
(Joins sheet 72)
R. 18 W.
R. 17 W.
2 150 000 FEET
395 000 FEET
T. 90 N.
(Joins sheet 78)
(Joins sheet 80)
390 000 FEET
2 160 000 FEET
27
26
25
30
34
35
36
31
Gran Creek
GRUNDY
COUNTY
1 Mile
5 000 Feet
Scale 1:15 840
¼
½
¾
1 000
2 000
3 000
4 000
5 000

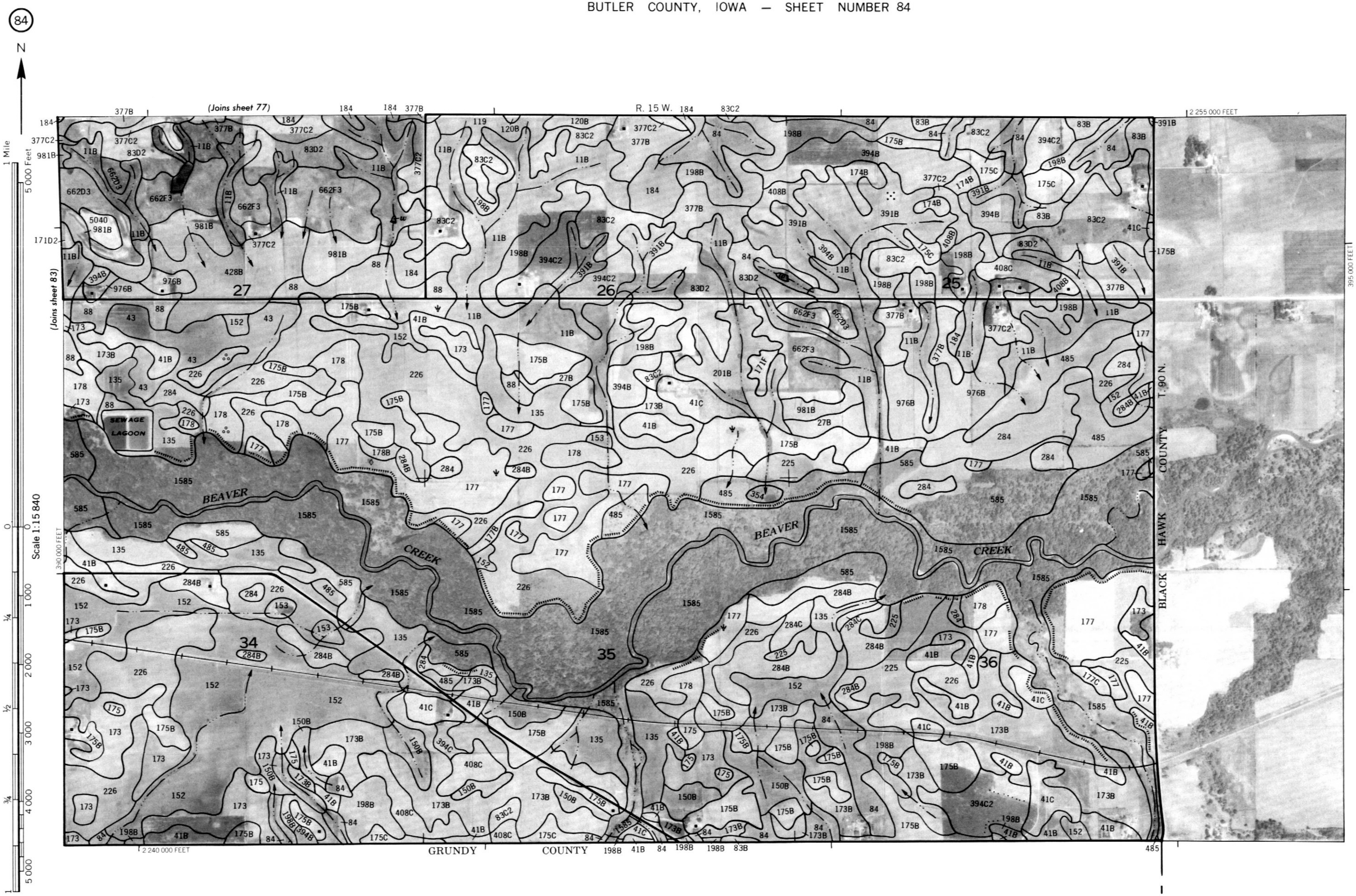

N
Scale 1:15 840
1 Mile
5 000 Feet
(Joins sheet 73)
(Joins sheet 79)
(Joins sheet 81)
Aplington
R. 17 W.
T. 90 N.
2 180 000 FEET
2 165 000 FEET
395 000 FEET
390 000 FEET
26
27
28
29
32
33
34
35
GRUNDY COUNTY


81
N
2 185 000 FEET
R. 17 W.
R. 16 W.
(Joins sheet 74)
395 000 FEET
T. 90 N.
(Joins sheet 80)
(Joins sheet 82)
390 000 FEET
2 200 000 FEET
BEAVER CREEK
BEAVER MEADOWS STATE PARK
PARKERSBURG
Beaver Creek
South Beaver Creek
Phelps Creek
GRUNDY COUNTY
26
25
30
29
35
36
31
32
1 Mile
5 000 Feet
Scale 1:15 840

BUTLER COUNTY, IOWA — SHEET NUMBER 82




(Joins sheet 76)
(Joins sheet 84)
(Joins sheet 82)
R. 16 W.
R. 15 W.
T. 90 N.
2 225 000 FEET
2 235 000 FEET
395 000 FEET
390 000 FEET
MOORES WILDLIFE AREA
BEAVER CREEK
New Hartford
GRUNDY COUNTY
25
29
30
28
36
31
32
33
N
Scale 1:15 840
1 Mile
5 000 Feet


84
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 77)
R. 15 W.
(Joins sheet 83)
2 255 000 FEET
395 000 FEET
390 000 FEET
2 240 000 FEET
SEWAGE LAGOON
BEAVER CREEK
BEAVER CREEK
27
26
25
34
35
36
T. 90 N.
BLACK HAWK COUNTY
GRUNDY COUNTY